8848

AMERICAN
GAS JOURNAL
Established 1850 — Pioneer of the Gas Industry

VOL. 127, No. 3
WHOLE NO. 2641

NEW YORK, SATURDAY, JULY 16, 1927

Subscription: $5 Per Year
$6 Canada $8 Foreign

A. G. A. *Laboratory*

APPROVED
GAS WATER HEATERS

FIRST
List Includes

Library of Congress
JUL 18 1927
Smithsonian Deposit

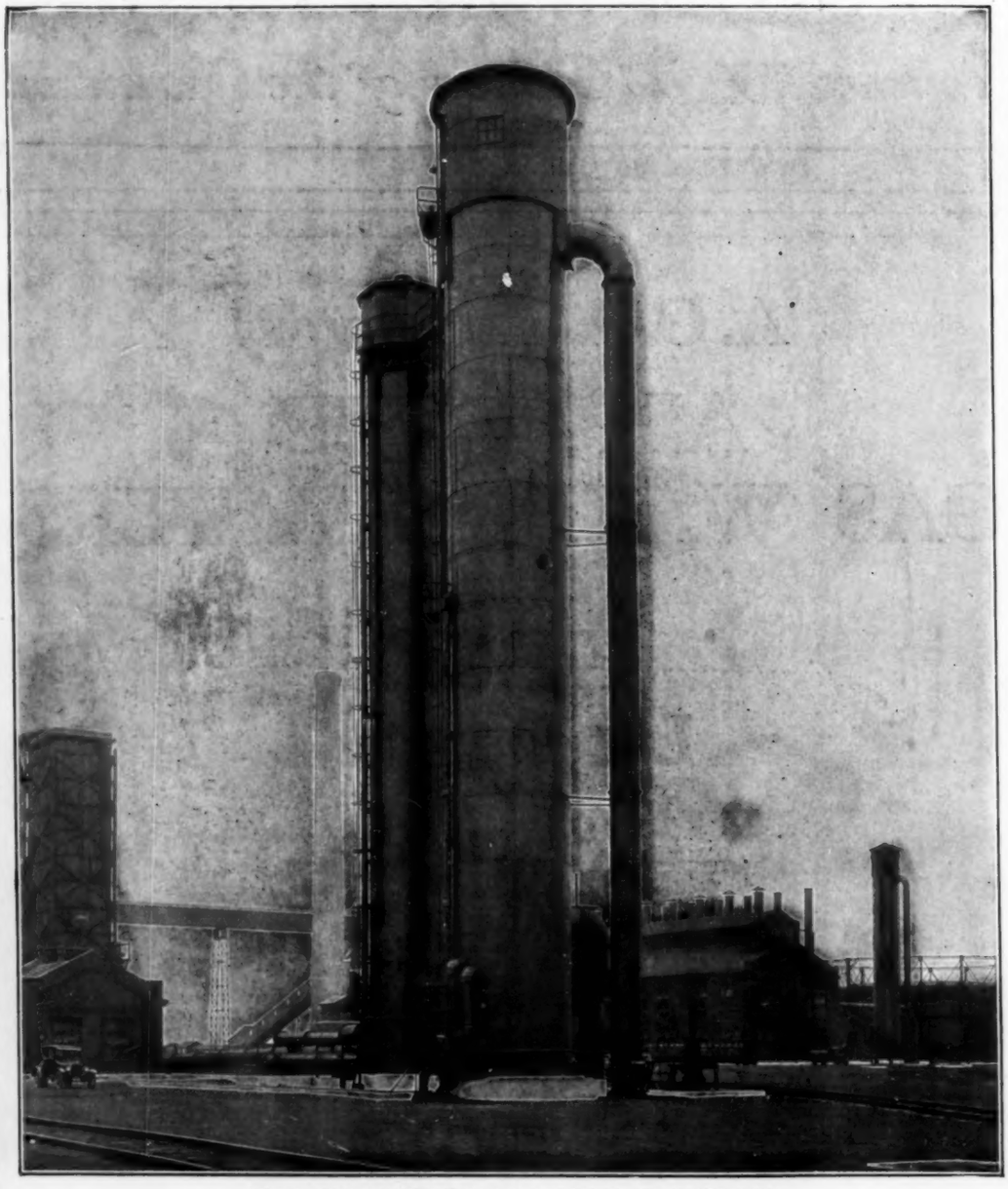
REX
GAS
WATER HEATERS

No. 32-53 Rex Automatic Storage Water Heater
No. 50 Rex Tank Water Heater
No. 70 Rex Tank Water Heater
No. 51 Rex Porcelain Enameled Water Heater

THE CLEVELAND HEATER COMPANY
1900 West 112th Street — Cleveland, Ohio

...rtising Index, page 37 ... Index to Contents, page 4

NAPHTHALENE REMOVAL PLANTS—(Patented)



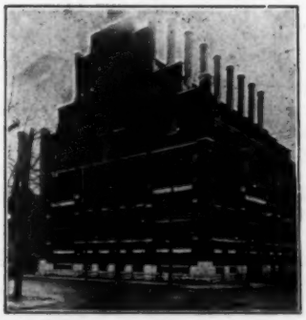
NAPHTHALENE INSTALLATION AT CHICAGO

The WESTERN GAS
CONSTRUCTION COMPANY

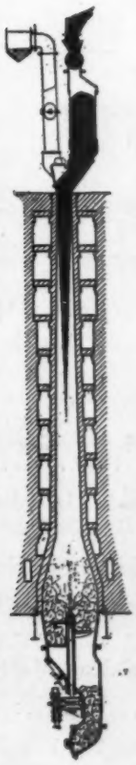
Subsidiary of The Koppers Company

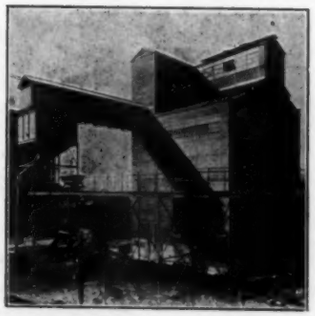
FORT WAYNE, IND.

GLOVER-WEST
Vertical Retorts

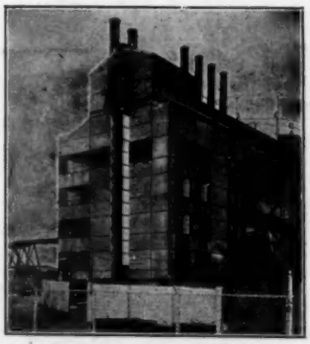


Toronto, Ont.
5,000,000 cu. ft. per day

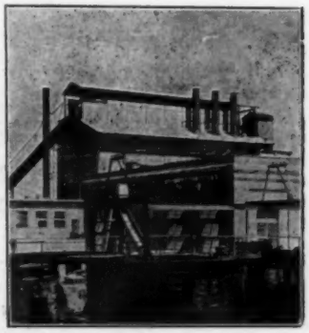




Fargo, N. D.
800,000 cu. ft. per day



Portland, Me., 2nd Plant
750,000 cu. ft. per day



Fall River, Mass.
1,600,000 cu. ft. per day

Plants *Completed* in 1926 and 1927

Also Completed—Stamford, Conn., 1,100,000 cu ft.; Buenos Aires, 3,500,000 cu. ft. Santiago, Chile, 3,000,000 cu. ft.; Toronto, Ont., 600,000 cu. ft. (extension)

Under Construction

Springfield, Mass. ..... 2,800,000 cu. ft.
Pawtucket, R. I. ..... 1,060,000 cu. ft.
Faribault, Minn. ..... 400,000 cu. ft.

WEST GAS IMPROVEMENT CO.

Builders of Coal Gas Plants

441 Lexington Ave. New York.

American Gas Journal

SIXTY-SEVENTH YEAR

Published Weekly by American Gas Light Journal, Inc., 53 Park Place, New York, N. Y.
S. G. KRAKE, Pres. and Treas. A. M. GLEASON, Sec'y

STANTON G. KRAKE, Managing Editor HENRY M. RILEY, Editor
Ismar Ginsberg, Associate Editor

"MEMBER OF THE AUDIT BUREAU OF CIRCULATIONS"

Contents of This Issue

Gasification of Fuel With the Aid of Oxygen and Steam—Dr. Tito Cerasoli 49
Outline of the Principal Methods Used by Public Service of New Jersey to Supply 700,000 Gas Customers—Harry Ellis 53
Refrigeration by Direct Application of Heat—Hugh E. Keeler 56
Surplus Heat Utilization Possibilities in Canadian Coal Gas Plants —W. C. Philpott 61
Window Display Advertising—Ray Martin 63
As the Journal Views It 64
Industrial Gas Lesson—Lesson No. 178 65
Gas Merchandising Ideas for the Man Who Sells—W. H. Matlack 66
This Plan Gets Bona Fide Appliance Prospects—Ruel McDaniel .. 67
Progress in Gas Technology 69
News of the Gas Industry 70

Subscription $3.00 per year, including postage, in the United States, Mexico, Cuba, Porto Rico, Hawaii or the Philippines; in Canada, $4.00; foreign, $5.00—Single Copies, 10 cents.

AMERICAN GAS JOURNAL, JULY 16, 1927. Vol. 127. No. 3.
Published weekly by American Gas Light Journal, Inc., New York, N. Y.
Entered as second-class matter Jan. 9, 1917, at the post-office at New York, N. Y., under the Act of March 3, 1879.

AMERICAN
GAS JOURNAL
Established 1859— Pioneer of the Gas Industry

Vol. 127. No. 3 **NEW YORK, JULY 16, 1927** **Whole No. 3641**

Gasification of Fuel With the Aid of Oxygen and Steam

Dr. Tito Cerasoli, Rome. "L'Industria del Gas e degli Aquadotti," Volume 15, August, 1926

(Translated from Das Gas und Wasserfach, 1927, Pages 508-510.)

(This article, which first appeared in the standard Italian gas journal, and was translated into German and published in Das Gas und Wasserfach, is concerned with a very interesting subject. The author describes in it certain theoretical considerations that apply to the gasification of carbon and coal as well by means of a mixture of oxygen and steam. The author also calculates the consumption of oxygen and of steam in the operation and also the composition of the gas that is obtained in this process with the aid of chemical and thermal equilibrium conditions at definite temperatures. The work is of a purely theoretical nature, but it is of the greatest importance, for it gives the practical man, who is concerned with this matter, a clear explanation of the processes involved, and also furnishes him with all sorts of suggestions which may be worked up into practical realities. This article is enhanced in value by the numerous references which accompany it. It should be of considerable interest to the American gas engineer.—Trans.)

A GAS that is free from nitrogen is obtained when a mixture of oxygen and steam is introduced into a mixed gas generator in the place of moist air. The method of calculation which was developed by the author for mixed gas (see Annali de Chemica Applicata, volume 13, 1923, pages 258-270) can be used with but few changes in investigating and studying this gasification process. We will first describe briefly this method.

The Method of Calculation

It is assumed that one kilogram of carbon is to be gasified with the aid of steam and oxygen. Let W be the number of cubic meters of oxygen (at zero degrees C. and 760 millimeters pressure, equivalent to 32 degrees F. and thirty inches of water pressure), and let a be the kilograms of steam required for this operation. Then at zero degrees C. (32 degrees F.) and 760 millimeters pressure (30 inches of water), the volume of the steam will be

$$\frac{a}{0.805} \text{ cubic meters.}$$

The symbols x, y, z and h denote the cubic meters of carbon dioxide, carbon monoxide, hydrogen and water (at zero degrees C. or 32 degrees F. and 760 millimeters pressure or 30 inches of water). The symbol t denotes the temperature of the gas at which it is assumed that the ingredients of the gas are in a state of chemical equilibrium.

The six unknown quantities, x, y, z, h and t, can be related together by means of six independent equations. The following three equations can be obtained with the aid of stoichiometric considerations. These are as follows:

$$(1)\quad x + y = 1.86$$

$$(2)\quad \frac{a}{0.805} = z + h.$$

$$(3)\quad w - x + \frac{y}{2} - \frac{z}{2}$$

The state of equilibrium of the gas constituents is represented by the following equations:

$$(4)\quad \frac{19500}{273+t} - \ln. \frac{x(x+y+z+h)}{y^2} = 19.5$$

$$(5)\quad -\frac{5000}{273+t} + \ln.\frac{xz}{yh} = -5$$

In addition thereto the condition of thermal equilibrium must also be fulfilled, with the result that the sixth equation can therefore be written.

The quantity of heat that is introduced into the generator is equal to the sum of the potential heat of the carbonaceous material (8100 kilogram calories) and the sensible heat in the mixture of oxygen and steam. The latter quantity of heat is placed equal to 37 kilogram calories. This is an average value which is obtained from the following calculation. The aforementioned sum is reduced by 324 kilogram calories, that is equal to the heat loss in the generator through conduction and radiation (4 per cent of the heating value of the carbon fuel).

$$(6)\quad 7813 = x(0.37t + 0.00022t^2) + (x + y).(0.303t + 0.000027t^2) + h(0.34t + 0.00015t^2) + 3062y + 2613z.$$

Solving the Equations

The six equations which have been established as above can be solved in the well-known manner. (The data on the specific heat and the heat of combustion of the gas and of the carbon fuel is taken from Richards' Metallurgical Calculations.)

The results of just five calculations are given in tabulation No. 1 and in these calculations the use of various quantities of steam is assumed in the gasification process as carried out in the steam-oxygen gas generator.

It can be very readily determined from the below tabulation that the production of heat in such a gasification process is very great. The quantity of steam that is required for these operations can be generated by utilizing the heat that is inherent in the gas.

TABULATION NO. 1

No.	Steam used in pounds per lb. coal.	Oxygen used in cu. ft. per lb. coal.	Saturation temperature of oxygen in deg. F.	Equilibrium temperature of gas in degrees F.	Composition of gas			Water in oz. per cu. ft. of gas.	Quantity of gas obtained in cu. ft.
					CO_2	CO	H_2		
1	0.250	12.3	154	3740	0.009	85.74	14.24	0.0004	75.9
2	0.375	11.2	168	2462	0.26	80.08	19.66	0.0041	81.5
3	0.500	10.7	176	1670	2.67	73.71	23.61	0.0152	82.9
4	0.750	10.3	187	1490	8.22	62.26	29.52	0.0462	92.3
5	1.000	10.2	209	1400	13.30	52.70	34.00	0.0711	99.3

No.	Heating value of gas in B.t.u. per cu. meter		Total heat led away by gas in B.t.u.			Loss in generator % of 8100
	Lower		Intrinsic	Latent Lower	Latent Upper	
1	340	341	5820	25800	26400	2.5
2	336	347	4250	27250	28150	2.4
3	325	339	3000	27150	28150	4.6
4	304	320	3140	28050	29550	3.5
5	284	302	3380	28000	29800	3.2

Heat Absorbed

The heat that is absorbed by the gas is then given by the following formula:

$$x(0.37\,t + 0.00022t^2) + (y + z).(0.303t + 0.000027t^2) + h(o.34t + 0.00015t^2)$$

(For the derivation of this equation and the others the reader is referred to Le Chatelier, Industrial Heating, Leipzig, 1922, Akademische Verlagsgesellschaft, pages 52 to 75, W. Schuele, Technische Thermodynamik, volume 2, Berlin, 1923, Springer, fourth edition, pages 225 to 229, 239 to 242, 246 to 250.)

The potential heat (lower value) of the gas is given by the formula: $3062y + 2613z$.

Then when the quantity of heat that was introduced into the generator was set equal to the quantity of heat that was drawn from it, a status of equilibrium was accordingly attained in accordance with the following equation:

An Example

Suppose we consider just case number 1 in the above tabulation. On the assumption that the gas has a temperature of 392 degrees F. at the outlet of the boiler, a total heat of 5,530 British thermal units are given up to the boiler in leading the gas through the waste heat boiler. When it is assumed that 10 per cent of the heat is lost in radiation and conduction there remain 4,977 B.t.u. for the production of steam. This then means that with one pound of gasified carbon there are obtained 1.96 pounds of saturated steam at a pressure of five atmospheres (75 pounds per square inch), while the quantity of steam that is required for gasification is only 0.25 pound.

In all the cases that were considered the quantity

of heat that is obtained from the inherent heat of the gas is greater than what is required for the gasification process.

The thermal yield of the gas in B.t.u. is equal to the following in each of the five cases that have been considered, viz., 82 per cent, 87 per cent, 88 per cent, 91 per cent and 92 per cent, respectively, of the heat that is potentially contained in the coal. Hence, following out the calculation that has been given above, it will be found that in each of these cases there will be obtained more steam than is required for the gasification of the coal. The excess steam productions are, respectively, as follows: 1.71 pounds, 1.03 pounds, 0.46 pounds, 0.25 pounds and 0.07 pounds. The pressure of the steam is seventy-five pounds per square inch.

Comparison With Ordinary Water Gas

When a comparison is made between these figures and the heat yield figures of an ordinary water gas generator, in whose operation a yield of 68 per cent is obtained under the most favorable conditions (the inherent heat in the gas being utilized to good advantage), it will be seen that the aforedescribed method possesses considerable advantage over the old type of operating a water gas machine.

The gas that is produced in accordance with the new method will have a greater heat content than ordinary water gas, and this is, to be sure, due to the fact that the proportion of carbon monoxide in the new gas is greater and also due to the fact that there is no nitrogen present in the gas. Inasmuch as the gasification process is a continuous one, no valves are required on the apparatus.

The production of gas per unit of cross-sectional area of the generator must also be greater in the case where a mixture of oxygen and steam is used, for the reason that the process is a continuous one and the temperature in the generator is higher. A particular advantage is gained in the circumstance that the ash and clinker are removed from the water gas generator in the molten state.

The coal that was used in the complete gasification process in a Strache generator (see S. Masse, The Distillation of Coal, page 263) had the following composition: Moisture, 2.25 per cent; ash, 6.70 per cent; volatile ingredients, 33.75 per cent, and fixed carbon, 57.30 per cent. The gas obtained from one pound of coal was 234 cubic feet and it had the following composition: Carbon dioxide, 7.042 per cent; oxygen, nothing; CnHm, 2.812 per cent; carbon monoxide, 27.25 per cent; hydrogen, 47.992 per cent; methane, 6.39 per cent, and nitrogen, 8.514 per cent. The thermal value of the gas was 384 B.t.u. per cubic foot.

It is possible to calculate from these figures the quantity relations that exist between water gas and mixed gas. It is deduced from the analysis that there are 0.805 pound of carbon in 51.5 cubic feet of the mixed gas.

Further Calculations

It may be assumed that one pound of the coal used contains 0.820 pound of carbon. Inasmuch as the fixed carbon content amounts to 0.573 pound, the carbon content of the volatile ingredients is equal to 0.247 pound. In the complete gasification of the coal there are obtained from one pound of coal 0.1 pound of coal tar, which contains about 0.08 pound of carbon. 0.167 pound of carbon goes over into the gas from the volatile ingredients of the coal and 0.199 pound of the carbon in the mixed gas arises from the water gas (0.366 less 0.167 pound).

When it is assumed that the average composition of the water gas is as follows: carbon dioxide, 4 per cent; carbon monoxide, 39.9 per cent; hydrogen, 51.0 per cent, and nitrogen, 5.1 per cent, the maximum heating value of the gas is 316 B.t.u. per cubic foot; so that 29.5 cubic feet of water gas are obtained with 0.44 pound of coal.

When these figures are used in the calculations the values that are given in Tabulation No. 2 are obtained.

TABULATION NO. 2

	Gas components obtained from one pound of coal						Gas	
Kind of Gas	CO_2	CnHm	CO	H_2	CH_4	N_2	total cu. ft.	B.t.u. per cu. ft.
Mixed gas	0.1034	0.0413	0.4005	0.7060	0.0939	0.1249	51.4	565
Water gas	0.0336	.....	0.3360	0.4295	.....	0.0429	29.4	268
Coal gas	0.0698	0.0413	0.0645	0.2765	0.0939	0.0820	22.0	297

In cases 1 and 2 (see the above tabulation No. 1) the ash was actually melted (by the introduction of a suitable flux with the fuel), for the reason that the temperature is higher in the fire zone of the generator than that of the gas itself, and inasmuch as the ash and clinker would be melted at the temperature of the gas, without the necessity of going to a higher temperature.

Complete Gasification Application

We will now consider the application of the above process in complete gasification in place of the production of water gas.

Thermal Considerations

The heating of the coal and the distillation of the volatile ingredients takes place at the expense of the potential heat in the water gas and of the steam that remains in an undecomposed state after the formation of water gas. This quantity of steam is figured to be 0.28 pound. (In order to produce 35 cubic feet of water gas, it is common practice to employ 1.2 pounds of steam, while the hydrogen which is contained in the water gas corresponds to only 0.09 pound of steam. It therefore follows that 0.33 pound of steam did not enter into the reaction. Hence 0.28 pound of steam did not react with the carbon in the case of the production of 29.5

cubic feet of water gas, which is commonly obtained in the complete gasification process.)

Inasmuch as the temperature of approximately 1,832 degrees F. is attained in the steam and water gas, these bring into the retorts of the generator (this is the term applied to that portion of the generator where the coal is degasified) a total of 38.6 B.t.u., which are sufficient to heat up the coal to dry the fuel, to drive off the volatile matter and to compensate for the various heat losses.

It is assumed that the complete gasification process is carried out by the introduction of a mixture of oxygen and steam into the generator, and we refer here to case 1, shown in Tabulation No. 1. On the assumption that 0.067 pound of carbon goes over into the clinker and ash (hence a clinker is obtained with 10 per cent of unburnt combustible matter), there are obtained from one pound of coal (0.573—0.067) × 76.5, or 38.4 cubic feet of water gas (see Tabulation No. 1), and this absorbs 1459 × 1.097/2.169 kilogram calories, or 83.4 B.t.u. Of this amount of heat only 38.6 B.t.u. are required for the distillation.

Further Calculation

An amount of 38.4 cubic feet of water gas goes over into the mixed gas (see Tabulation No. 2), and in addition thereto 19.1 cubic meter of coal gas (the nitrogen is removed and hence is present in the coal gas in only an inappreciable amount). For this reason the mixed gas has a volume of 57.5 cu. ft. (see Tabulations Nos. 1 and 2) and a maximum heating value of 3066 × 1.097 + 2642 = 6005 kilogram calories, or 684 B.t.u. In addition thereto the gas contains certain inherent heat (which is independent of the inherent heat in the coal gas) and which amounts to 44.8 B.t.u. (83.4 — 38.6). This heat will produce approximately 1.1 pound of steam in the waste heat boiler, while the amount required for the gasification of one pound of coal is equal to 0.28 kilograms.

When these results are compared with those which are ordinarily obtained in the complete gasification of coal, as carried out by the common process, there is a considerable increase in the thermal yield, amounting to approximately 20 per cent. In addition thereto the gas that is obtained in the new process has a greater heating value, that is, 414 B.t.u. in place of 379 B.t.u.

Greater Increase Possible

It is, however, still possible to increase the heating value of the gas beyond this value. It is also possible to allow a certain amount of the water gas to be diverted, and the result then is that the quantity of water gas that is permitted to flow through the retorts is only sufficient to gasify the coal, in that the water gas yields up its sensible heat content.

The amount of water gas that is required for this purpose is shown in the following equation:

$$1.097 \times \frac{340}{735},$$

or 0.506 cubic meters of gas, that is, 17.7 cubic feet of water gas. There are, therefore, obtained 36.8 cubic feet of mixed gas, and the total amount of heat obtained is equal to 0.506 × 3006 + 2642, or 4193 calories, which are equal to 475 B.t.u. The mixed gas will therefore have a maximum heating value of 453 B.t.u. per cubic foot

In addition thereto there will be 20.7 cubic feet of water gas available for other purposes, this water gas possessing a maximum heating value of 348 B.t.u. per cubic foot. The amount of oxygen which is required for the complete gasification of the coal, based on one pound of coal, is equal to 6.15 cubic meters

$$(0.775. \frac{1.097}{2.619} \text{ cubic meters equal } 0.387 \text{ cubic meters.})$$

(See Tabulation No. 1.)

In order to produce one cubic foot of the mixed gas, it will be necessary to use 3.74 cubic feet of oxygen. When a study is made of the process of gasification which has been described above from the economic standpoint, the following observations can be made. In the first place a total of 566 B.t.u. are obtained from 2.2 pounds of coal in the ordinary type of mixed gas generator, while when the operation is carried out with the aid of oxygen gas, the heat obtained amounts to 680 B.t.u., which means an increase of 114 B.t.u.

Conclusions Regarding Methods

Without studying the two processes from any other standpoint, it may be concluded that the two methods, compared from the economic or industrial basis alone, may be concluded to be of equal value, if the price for 615 cubic feet of oxygen and for 114 B.t.u., which are contained in the gas possessing the higher heating value of 414 B.t.u. per cubic foot, would be the same. It can be established that as a general rule no equilibrium in costs can be reached. It is nevertheless still important to take into consideration the fact that the oxygen gas is a by-product of the manufacture of synthetic ammonia by the electrolytic method and at the present time this oxygen has no market. It therefore follows that in certain cases it would become advisable for the synthetic ammonia plants to use their excess oxygen gas for this purpose.

There will be available a total of 42,000 cubic feet of oxygen gas for every metric ton of nitrogen that is combined in the form of ammonia, and this quantity of oxygen gas is sufficient to produce a total of 179,000 cubic feet of gas, possessing the maximum heating value, that is 414 B.t.u. Then in accordance with the above representation, there will be obtained 12.4 million B.t.u. more than are obtained in the common method of producing gas by complete gasification.

In concluding this article, it might be mentioned that the German translator of the original Italian article undertook to test the accuracy of some of the figures that are given in Tabulation 1. His conclusion was that the calculations that were made by the Italian investigator were correct and agreed very well with those that he himself had made. This

is an interesting and important indication of the worth of this article, and shows that the American gas engineer can likewise apply the methods and figures that are given in this article to his own case. The figures that are given in Tabulations 1 and 2 are of real practical value, although they have been established on a purely theoretical basis, but here again we have an exemplification of the well-known saying that the most practical thing is, after all, the well-founded and well-substantiated theory. It is our belief that Dr. Cerasoli's methods and principles are worthy of this characterization.—(Trans.)

Outline of Principal Methods Used by Public Service of New Jersey to Supply 700,000 Gas Customers

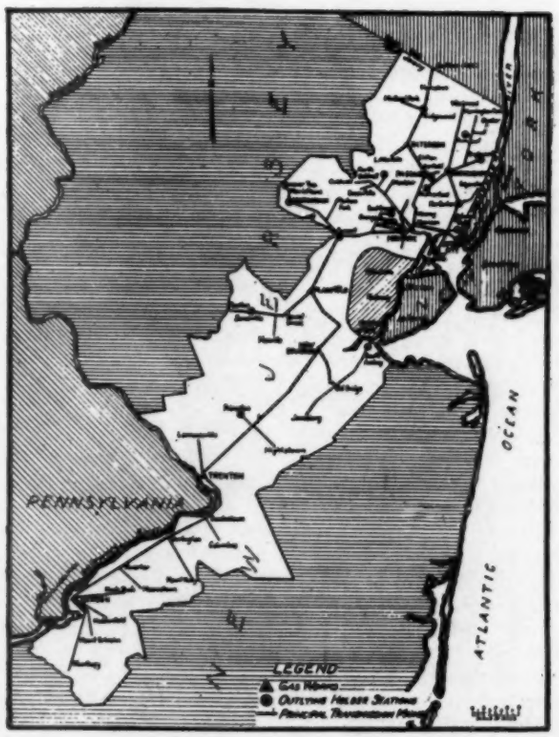
Harry Ellis

Public Service Electric & Gas Co., New Jersey

THIS company serves a population of 3,000,000 people occupying 1,600 square miles of the most prosperous section of New Jersey situated between the two largest cities of the Union, New York and Philadelphia.

The requirements are supplied by two by-product plants, and ten carburetted water gas plants (four plants inactive, but maintained for contingencies) having a combined daily capacity of 125,000 M.C.F., twenty-five holder stations having a storage capacity of 72,000 M.C.F., and 4,000 miles of street mains; the resultant of corporate consolidations and the interconnection of thirty independent plants within the past forty years.

The gas is distributed by three distinct methods, namely low pressure systems, wherein the gas is supplied through the medium of a governor which maintains 4-inch (water) initial pressure; intermediate pressure systems, wherein the gas is dispatched under an initial pressure of 5 to 10 lbs. by positive rotary pushers; and high pressure systems, wherein the gas is dispatched by piston type compressors under an initial pressure of 30 to 50 lbs. Some of our low pressure systems are supplied by a holder through the medium of a station governor, whereas others are supplied by intermediate or high pressure mains through the medium of district governors.



Territory Served

Origin of Intermediate Systems

Our intermediate systems had their origin in the conversion of low pressure trunk mains for higher pressures after they became inadequate to deliver the necessary amount of gas under an initial pressure of 4-inch (water). Such conversions involved the disconnection of small lateral mains from the trunk main and the installation of district governors on the larger intersecting mains. These governors are located in masonry manholes and are provided with a seal pot to avoid the accumulation of excessive pressures on the supplied districts, should the governors become deranged. Service governors are installed on the individual services connected to the said trunk mains. The conversion of these mains for higher pressures saved immense sums of money which would otherwise have been necessary for additional large mains.

* Read before the Canadian Gas Association, Toronto, Canada, June 16-17, 1927.

The installation of pushers was deferred some years after the conversion of a low pressure main when 6-inch to 15-inch pressure was directly obtainable from the holders. For some time after their installation it was necessary to operate them during the maximum demand periods only, whereas now many are operated continuously.

In addition to a reserve pusher for contingencies, a diaphragm type governor is reversed between the outlet of the pushers and the holder, the same being adjusted to open a few tenths less than the pressure delivered by the holder. This governor is normally closed but is intended to step in and insure the delivery of gas to the system should the steam supply fail, or other abnormalcy suddenly develop.

To prolong the adequacy of the transmission system and permit extensions thereto, 1,000 M. dry holders were constructed on the terminals of two arteries, the piston being weighted to deliver 20 inches (water).

Automatic Supply of Gas to Holder

Gas is supplied to these holders automatically by a quick closing gate valve actuated by the holder piston through the medium of a cable and counter weights. A diaphragm governor prevents this during the peak. Conversely, a diaphragm governor controls the send out, being adjusted to step in on the pumping main when the terminal pressure falls below 20 inches, thereby reducing the burden which would otherwise be imposed upon the pushers.

Many of the large mains leaving the works were laid years ago with lead joints which leaked when subjected to pressures in excess of those delivered by the holders. Joint clamps employing a rubber or braided asbestos gasket were used to effect repairs, but after a brief and woeful experience, a special split sleeve to envelop the bell was designed. These sleeves were made up with neat cement in a manner similar to that employed on the installation of an ordinary split sleeve, their adoption being promoted by the theory that the lead joint, when recaulked, would remain tight if maintained in a rigid position.

Large mains having cement joints also leaked when subjected to similar pressures, whereupon 1¼ inch of the joint was cut out, replaced with cast lead, and caulked, thereby constituting a composite cement-lead joint. All cast iron pipe 8 inches and larger laid in recent years has bells 6 inches deep without the lead groove, the joints being of the foregoing composite type. Screw end pipe is used for all H.P. mains excepting 12 inches or larger, which is welded. Fittings of all sizes are made of welded pipe.

Five Hundred and Seven Miles of Pumping Mains

Our entire territory comprising 190 separate municipalities is supplied by 507 miles of inter-connecting pumping mains. From our new Harrison plant gas is delivered by steam turbo driven centrifugal compressors to the following holder stations: Market Street, Newark; Ogden Street, Newark; Passaic; Roseville, East Orange; Summit; Morristown, Plainfield, and Caldwell, where one of the previously mentioned dry holders is located.

Gas engine driven rotary pushers are located at Passaic to care for the adjacent towns during the peak demand periods, or pump back into the supply main if necessary. For similar reasons rotary pushers driven by gas engines are located at Roseville and Summit. Steam driven compressors are located at Plainfield to relay gas to the Somerville holder and incidentally supply the intermediate towns by means of district governors. In case of necessity, gas can also be sent to New Brunswick, which ordinarily receives its gas from Trenton.

At the West End, Jersey City plant, steam driven rotary pushers deliver gas to the following holder stations: Sixth Street, Communipaw, Bayonne, Hoboken, Hackensack, Dumont, Englewood, and New Durham. Steam driven compressors are also located at this plant to deliver gas from the Seaboard By-Products Company to the previously mentioned Harrison plant via a tunnel under the Hackensack River. Rotary pushers, driven by gas engines, are located at New Durham for the delivery of gas to holders at Hackensack, Dumont and Englewood. A steam driven rotary pusher is also located at the Communipaw plant for reserve purposes.

Location of Additional Compressors and Pushers

Steam driven piston compressors are located at Hackensack to deliver gas to the Rutherford holder as well as reinforce pressures in adjacent towns by means of district governors. A steam driven rotary pusher is also located at this plant to deliver gas to another dry holder at Dumont during emergencies and supply gas to intervening towns by means of district governors.

Steam driven rotary pushers are located at Paterson for supplying the city and surrounding towns by district governors. Gas may also be pushed to the Passaic station which is normally supplied by Harrison. Steam driven compressors are also located at Paterson to supply the Ridgewood holder and a chain of towns extending to the New Jersey-New York State line by means of small steel mains and individual service governors.

Steam driven rotary pushers are located at the Camden combination by-product-carburetted water gas plant for supplying numerous adjacent towns by district governors.

Steam driven compressors located at this plant also supply Trenton by a 12-inch W. I. mains 38 miles in length, as well as numerous intermediate towns, by district governors. A number of towns are also supplied enroute by small high pressure lateral mains. This system had its inception with the construction of the coke plant, which necessitated expansion of the distribution system to dispose of the gas yield. The construction of additional ovens a few years later resulted in the installation of 33 miles of 10-inch steel pipe from Trenton to Plainfield via New Brunswick. These joint lines, including lateral extensions therefrom, resulted in the cessation of manufacturing gas in eight former in-

dependent plants. Steam driven compressors at the Trenton auxilliary carburetted water gas plant relay the gas to New Brunswick, where gas engine driven compressors again relay the gas to South Amboy during the maximum demand periods. Gas may also be sent to Plainfield, which now receives its supply from Harrison via Summit.

Extra Main Across Navigable Streams

In general, an extra main is laid across all navigable streams, the same being connected to the main stem on each side of the streams so that continuity of supply is assured in the event of one line sustaining an injury. Extra heavy steel pipe is used for crossings 12 inches or smaller, whereas in larger sizes a trench is dredged, piles driven, capped, and C. I. flanged pipe laid thereon below the depth prescribed by the Federal government.

The company now has concrete tunnels at the most important sub-river crossings, one 400 feet long conveying two 30-inch mains beneath the Passaic River, Harrison; one 200 feet long conveying two 30-inch mains beneath the same river at Belleville, one 600 feet long conveying one 16-inch and two 24-inch mains beneath the Hackensack River, Jersey City, and one 240 feet long conveying two 12-inch H. P. steel mains beneath Coopers River, Camden, N. J. Compressed air was necessary in the construction of one of the tunnels, whereas two were constructed in solid rock by the "free air" method. In the remaining case, an open cut was made on one side of the stream, the tunnel constructed therein, after which a new course for the river was dredged within the lines of the shafts, the old channel being filled in with the effluent material.

Two hundred miles of wrought or steel pipe is utlized for high pressure, six hundred miles of cast iron is utilized for intermediate pressure, and the balance, 3,200 miles, most of which is cast iron, is utilized for low pressure distribution. The high and intermediate pressure mains involve the use of 596 district governors and approximately 16,000 service governors.

Personnel and Equipment

Our territory is divided into six divisions, each of which is supervised by an engineer of distribution and assistants. Each division is sub-divided into districts, each of which is supervised by a superintendent, general foreman, foremen, and inspectors. Twelve hundred men and 321 automobiles are required for repairing, installing and removing meters, repairing leaks, and installing and adjusting consumers' appliances. Five thousand additional seasonal employees are required for the annual installation of 250 miles of street mains and 26,000 services. Labor saving equipment, such as trenching machines, back-filling machines, portable air compressors, compressed air rock drills, power water pumps, portable cranes, and tractors are used wherever feasible.

In conclusion, this resume is merely a portrayal of our system as evolved from the interconnection of numerous smaller systems and expansions of the same, necessitated by increasing demand for our product.

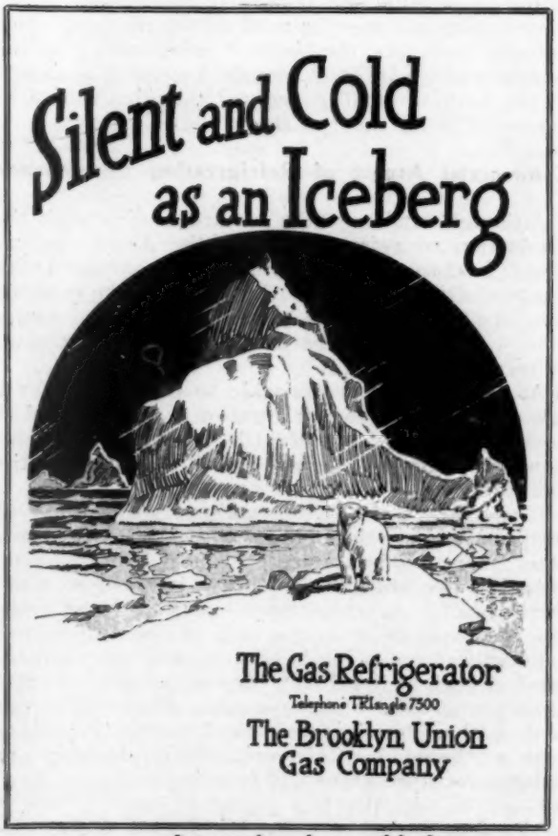
¤ ¤ ¤ ¤

100 CUBIC FEET OF GAS WILL DO A LOT

The average New York State home which uses manufactured gas consumes less than 100 cubic feet a day, according to the New York State Committee on Public Utility Information. One hundred cubic feet of gas, if used for one operation, would perform the following domestic or industrial tasks, says the Committee:

1. Bake 5 loaves of home-made bread.
2. Broil 7 three-pound steaks.
3. Boil 27 gallons of water.
4. Cook enough ham for 175 sandwiches.
5. Roast coffee to make 5,000 cups, and cocoa beans to make 4,500 cups.
6. Bake 50 bricks.
7. Anneal 62 pounds of fine wire, or 25 pounds of steel.
8. Japan 260 talcum powder cans.
9. Prepare varnish to cover 2,400 square feet of hardwood floor.

¤ ¤ ¤ ¤



——but a maker of warm friends

Refrigeration by Direct Application of Heat*

Description of fundamental principles and discussion of some commercial aspects of the subject

Hugh E. Keeler, M.S.E.

Assistant Professor of Mechanical Engineering, University of Michigan

IN presenting this paper I wish to state at the outset my recognition of the fact that I am addressing persons more or less familiar with the production of refrigeration by the combustion of illuminating gas in suitably designed apparatus.

Many excellent articles have appeared in the last two years in the technical press relative to refrigeration with gas as applied to household and small commercial installations. The titles of many of these articles have been such as, "Refrigeration with Gas," "Gas Refrigeration," etc., and have been unusually well chosen.

It has occurred to me that it might be well to emphasize the fact that what we are fundamentally concerned with is not "Refrigeration with Gas," or "Gas Refrigeration," "but "Refrigeration by Direct Application of Heat," hence this was chosen as the title of this paper. An idea that is getting prevalent in the public mind is that in some mysterious fashion illuminating gas may be used as the medium which actually produces the desired refrigerating effect, which is, as we all know, not the fact in the case and in the interest of all concerned this idea should be corrected in the mind of the public.

Commercial Aspect of Refrigerating Phenomenon

Although fundamentally we are dealing with the production of refrigeration by the direct application of heat we are here commercially concerned with the production of refrigerating effect by the combustion of illuminating gas in suitably designed equipment for household, apartment and small size commercial installations.

At this point it is desirable to bring together a few facts relative to refrigeration in general and to point out the various methods by which refrigeration may be produced which are of importance to the gas industry.

If two bodies of any substance, each at a different temperature, are brought into contact with each other, there will be a transfer of heat from the body of high temperature to the body of low temperature; the body of high temperature losing heat and dropping in temperature and the body of low temperature gaining heat and rising in temperature, the temperatures of both bodies finally becoming equal. At this condition all flow of heat ceases. The body losing heat is thus "refrigerated," and the body gaining heat is "heated." Refrigeration and heating are simultaneous processes and it is impossible to have one without the other. Consider an ordinary hot-air, house heating furnace; here we abstract heat from the gaseous products of combustion and send them up the stack at a temperature much lower than they initially had in the combustion zone and therefore they are "refrigerated." The air, which it is desired to heat, in passing over the heating surfaces, absorbs much of the heat lost by the products of combustion and rises in temperature and is therefore "heated." However, since the purpose of a hot-air furnace is to raise the temperature of the air passing through it, we think of it as a heating device and not as a refrigerating device. It is worth noting here that in a perfectly insulated furnace the heat absorbed by the air would be exactly equal to the heat given up to the air by the products of combustion, or, in other words, the heating effect and refrigerating effect are equal.

What Happens in a Cold Storage Compartment

Now consider a cold storage compartment in which a low temperature is maintained by cold brine circulating through cooling coils placed in the compartment. Here we have heat removed from the air and articles stored in the compartment and a consequent reduction in their temperature, and we have heat absorbed by the brine in the cooling coils with a consequent rise in its temperature. Thus the air and articles stored in the compartment are "refrigerated," and the cold brine in the coils is "heated." But, inasmuch as the purpose of a cold-storage compartment is to reduce the temperature of the air and the articles stored therein, we think of it as a refrigerating device and not as a heating device. It should also be noted that in a perfectly insulated cold storage compartment the heat given up by the air and stored articles would be equal to the heat absorbed by the brine in the coils.

"Heating" is in general a very simple process because all that is necessary is to bring the substance to be heated in contact with a substance or a surface of higher temperature from which the flow of heat automatically takes place; it is analogous to the flow of water down an incline. "Refrigeration," on the other hand, is a much more complicated process than heating because heat will not automatically flow from a body at a low temperature to a body at a higher temperature; it is analogous to the fact that water will not flow up an incline of its own accord. It so happens that in our household and commercial refrigeration work that we desire to produce a temperature of substances stored in a confined space below the surrounding room temperature and we are

*Read at annual meeting Michigan Gas Association, Mackinac Island, July 5-7, 1927.

thus confronted with the problem of removing heat from substances at a low temperature and depositing it into a substance at a higher temperature. It is analogous to raising water from a lower to a higher level. To transfer heat from a body of low temperature to a body of high temperature requires the expenditure of work, just as it does in the case of raising water from a low to a high level.

We are now at the point where it is desirable to discuss the methods whereby mechanical refrigeration may be produced and determine which ones are adapted for use by the gas companies and why.

Two General Systems for Refrigeration

At the present time there are two general systems for the production of mechanical refrigeration, one called the "compression system," and the other called the "absorption system." The difference between these two systems will be discussed later on.

Suppose we wish to cool hot oil at a temperature, say, of 400 deg. F. to a temperature of 230 deg. F. A suitable way of doing this would be to circulate it through the tubes of a shell type heat interchanger, the shell of which contains water. We will assume further that the shell is vented to the atmosphere. After the water in the shell has risen to 212 deg. F., assuming atmospheric pressure to be 14.7 pounds per square inch, absolute, there will be no further rise in temperature and the water will evaporate and pass off through the atmospheric vent as steam, carrying large quantities of heat along with it. Thus for cooling oil from 400 deg. F. to 230 deg. F., water would serve as a very good refrigerant. Let us now assume that instead of cooling oil from 400 deg. F. to 230 deg. F., we wish to cool a calcium chloride solution from 30 deg. F. to 0 deg. F. It is evident that if we put the calcium chloride solution at 30 deg. F. into the tubes of our shell cooler that we could not have water in the shell as the refrigerant because it would soon freeze into ice and refrigeration would not occur. We must, therefore, look around for some other refrigerant which, assuming that our shell is still vented to atmosphere, will evaporate at a temperature at least equal to 0 deg. F., and preferably somewhat lower.

Reference to a table giving the properties of anhydrous ammonia shows that at atmospheric pressure this liquid evaporates at a temperature of —28 deg. F. and that it would be a suitable substance for this purpose.

If ammonia was cheap and inoffensive, all that would be necessary would be to keep the shell of the heat-interchanger fitted with it to the proper level. But since ammonia is expensive, offensive and dangerous, the ammonia vapor must be collected and restored to the liquid state ready to be used over again as a refrigerant.

Heat Interchanger Necessary

Every type of refrigerating machine, whether compression or absorption, must have this heat interchanger, in which the refrigerant evaporates at a temperature at least as low, and preferably lower, than the temperature which it is desired to produce. It may be simply a coil of tubing located in the space to be cooled or it may be a coil of tubing located in the tank of brine which is placed in the space to be cooled.

In order to convert any gas to a liquid it is of course necessary to compress and cool it. It is the method employed to compress the gas which principally distinguishes the compression system from the absorption system. The most common method of compression is to use some type of power-driven compressor.

By far the greater number of household refrigerating machines in service and on the market today employ reciprocating, piston type compressors driven by electric motors. The compressed gas after leaving the compressor passes to a condenser of either the air or water-cooled type and there gives up a large portion of its heat content and is converted into a liquid, ready to again enter the heat-interchanger, also known as the expansion-coil, or ammonia boiler, to again go through its cycle.

The method and mechanism for compressing the gas constitute one of the essential differences between a compression and an absorption system. It should be noted that while ammonia is here chosen as the refrigerant in both the compression and absorption systems under discussion, because it may be used in either, and that although it is much used in commercial compression machines, it is very little used in household compression machines.

Compression Type Adaptable Where Electricity Is Used

The compression type of machine is particularly adapted where refrigeration is to be produced by the expenditure of electrical energy because of the ease and good efficiency with which it may be converted into mechanical work by means of an electric motor and transmitted to the compressor by highly efficient belts or gears. The electric motor is especially suitable for automatic starting and stopping by means of a thermostat.

The compression type of machine, requiring, as it does, a source of power for the operation of the compressor, is not at all adapted to the condition where refrigeration is to be produced by the combustion of illuminating gas because the only practical way of converting some of the heat available in the illuminating gas into power available for driving the compressor is by means of a small gas engine. It is at once evident that this is not a practical scheme. The small gas engine would require attention, would be noisy; would not be adapted to automatic starting and stopping and would be low in efficiency. These together with other objectionable features make the combination of a small gas engine driving a compressor an impractical one for household service. Now the question arises as to how the low pressure gas coming from the heat-interchanger or ammonia boiler can be compressed to the necessary pressure and delivered to the condenser. It is very fortunate that physical processes

exist whereby this may be accomplished and those which are now used in available gas-fired refrigerating machines will be discussed.

Assume that we have an open vessel containing one cubic foot of water which is maintained at a constant temperature of 50 deg. F. by means of a submerged cooling coil and that we bubble through this water ammonia gas at atmospheric pressure. Under these conditions this one cubic foot of water will absorb 898 cubic feet of ammonia gas before absorption ceases. Now suppose that the cooling water is turned off from the coil and that steam is turned into the coil and that this ammonia solution is heated from 50 deg. F. to 212 deg. F. This heating will expel ammonia gas from the solution until only 97 cubic feet remain dissolved. This gives us 801 cubic feet of ammonia gas expelled per cubic foot of water as the result of heating.

Practical Application of Principles

To show how this is practically applied, assume that we connect the ammonia gas outlet from a heat interchanger or ammonia boiler to a closed tank containing water and fitted with a submerged pipe so that the incoming ammonia gas passes through this pipe, bubbles up through the water and is absorbed by it. Further assume that there is a coil submerged in the water in this tank and that cooling water is passed through this coil. This cooling water is necessary because much heat is generated when ammonia gas is dissolved in water and it is necessary to keep the water cool during this absorption process or absorption would soon cease. Finally the condition of complete saturation will arrive and the water will absorb no more ammonia gas. Let us now disconnect the tank of strong aqua ammonia from the ammonia boiler and connect the space above the water to the ammonia condenser; cut off the cooling water from the submerged coil and heat the strong ammonia solution either by connecting the submerged coil to a steam supply or by applying heat to the shell of the tank, say by means of a gas flame. As this heating progresses the pressure builds up to the required high value and much ammonia gas is expelled from the water, and driven over to the ammonia condenser where it is liquefied and from which it flows to the receiver for liquid ammonia or directly back to the ammonia boiler ready for use in producing the desired refrigerating effect.

It is important now to note five things:

1. That when the water in the tank is absorbing ammonia gas this assembly is doing the same thing that a piston compressor does in its suction stroke, namely, removing ammonia gas from the heat-interchanger or ammonia boiler. During this time the water and the tank comprise an assembly serving as and known as an "absorber."
2. That when the strong ammonia solution in the tank is being heated and ammonia gas is being expelled therefrom and forced over into the condenser, this assembly is doing the same thing that a piston compressor does on its compression and discharge stroke, namely, increases the pressure on the ammonia gas and forces it over into the condenser. During this time the water and tank comprise an assembly serving as and known as a "generator."
3. That this is an intermittent cycle of operation.
4. That this method dispenses with a power-driven compressor.
5. That this is "Refrigeration by Direct Application of Heat," and that the source of heat is merely incidental to the process and may be of many kinds although illuminating gas is our most desirable, readily controlled and economical source of heat for household refrigeration.

Adsorption

Another method may be employed to accomplish the same thing that the above described "generator-absorber" accomplishes. In the previously described process, use has been made of the ability of water to "absorb" ammonia gas; now we will describe how certain solid materials may be made use of to "adsorb" ammonia gas or other suitable gases. It is a known physical fact that many solid materials will adsorb large quantities of gases. For example, charcoal will adsorb many times its own volume of ammonia gas and calcium chloride will do the same thing. If instead of water we have a shell filled with an "adsorbent" and connect it to the heat-interchanger or ammonia boiler, it will adsorb the ammonia gas up to the point where it can adsorb no more. When this condition is reached the connection to the ammonia boiler is broken and connection established to the ammonia condenser and heat is applied to the solid adsorbent with the consequent liberation of most of the ammonia gas. The pressure of course rises and the ammonia is forced over to the condenser and is restored to the liquid state. When the adsorbent has released all of the gas possible by heating, the heating is discontinued, the adsorbent cooled down and the shell containing it again connected to the vapor space of the ammonia boiler. It is important to note here that the adsorbent must be allowed to dissipate heat either by air or water cooling while it is adsorbing ammonia gas, as heat is produced during the adsorption process.

In a machine employing this method we may say that the function of the compressor in a compression system is performed by the "generator-adsorber."

Still another process is possible by the use of "Silica-Gel" as the adsorber and water vapor as the refrigerant. This remarkable material has enormous adsorptive ability and gives much promise for application in the household type of refrigerating machine. Adsorption is the condensation of a gas or vapor on a surface and occurs practically instantaneously.

It is not possible, nor desirable, in a paper of this sort, to attempt to go into a large amount of highly technical theory and detailed discussion of various machines.

What has been attempted up to this point is to show the following:

1. That a compression type of household machine is not practical for any process where mechanical refrigeration is to be produced by the combustion of illuminating gas.
2. That mechanical refrigeration may be produced by the "direct application of heat," and that a power-driven compressor is not required. The attempt has also been made to give a brief and general idea of the principles by which refrigeration by direct application of heat may be produced and how these principles may be applied in actual service.

Machines Available for Purchase

In looking over the machines available for purchase by gas companies it must be admitted that they are rather few in number. When one comes to realize the very short period of their intensive development and exploitation it is quite remarkable that there are as many as there are and that they are developed as well as they are. All machines available at the present time operate on an intermittent or a continuous cycle. The "Sorco," the "Common-Sense" and the "Ice-O-Lator," are examples of machines employing an intermittent cycle, while the "Electrolux-Servel" is an example of a machine employing a continuous cycle.

They may be further classified as operating on the "adsorption" or "absorption" principle. The "Ice-O-Lator" is an adsorption machine as well as any machine that may employ Silica-Gel or similar substances in its operation. The other machines previously noted are examples of absorption machines.

It should be noted that in a broad, thermodynamic sense there is no difference between a compression machine and an absorption machine, in that they all remove heat by the application of heat. If you follow a kilowatt-hour back from the electric motor you will ultimately end up in a fire directly applying heat to a steam boiler and if you follow back from the fire you will go back through the coal pile to solar energy. If the kilowatt-hour happens to be produced by a hydro-plant, the water operating it was lifted to its high operating level by evaporation into water vapor from the water surfaces on the earth at lower levels and subsequently condensed as rainfall and deposited at the higher level, so here we again have refrigeration produced by the application of heat with the sun as the ultimate source of the heat.

Present methods should not be considered final, and it is worth while to note that mechanical refrigeration may be accomplished by the direct application of heat; may have no "generator-absorber" or "generator-adsorber"; no moving mechanical parts and may operate on a continuous cycle.

Westinghouse-Leblanc Machine

Such a machine was the Westinghouse-Leblanc water-vapor refrigerating machine. This machine used water or brine as the refrigerant and handled the water vapor coming from the expansion coils by means of kinetic ejectors operated with steam. A machine of this sort, if built in miniature as a small household machine would have a very low efficiency, but it offers opportunity for renewed activity in the development and adaptation of this type of equipment.

The development of this type of apparatus is a problem for very skilled designers of jet apparatus, but a great deal is possible of accomplishment. This apparatus might conceivably be built as a hermetically sealed air-cooled machine. If other refrigerants than water were more desirable there is nothing, theoretically at least, to prevent their use. This is just a hurried survey of this branch of refrigerating engineering; there is a broad field and a very large background. I do not believe that any machine of either the absorption type or adsorption type will entirely and indefinitely prevail as the principal types in the field where refrigeration is to be produced by the direct application of heat.

However, I readily concede that this is merely personal opinion and that prophecy is dangerous.

As another interesting method of production of refrigeration by the direct application of heat, consider an ordinary thermocouple composed of two dissimilar metals joined together at their free ends. Upon heating one of the junctions a thermal electromotive force is produced and an electric current flows in the circuit. Simultaneously with this there is a cooling at the other junction, the so-called "cold-junction."

One may conceive of a large group of thermocouples having their cold-junctions inside of a space to be refrigerated and their hot-junctions outside, these hot-junctions being heated by a gas flame. This would be a "beautifully simple," and a "simply beautiful" method, but unfortunately nothing indicates it to be of commercial importance and everything indicates that it is not.

I consider that the gas companies may look forward to substantial and continued development and progress in the field of household refrigerating machines. Much of this progress will result from the correlation of a great deal of scattered engineering and physical data and its incorporation into radically new types of household machines.

Commercial Aspects of Household Refrigeration

From here on I wish to consider the commercial side of household refrigeration with gas; a subject of the utmost importance.

It will be interesting to review the subject of mechanical refrigeration from the standpoint of the electric generating companies and from the standpoint of the gas companies.

When the first types of household refrigerating machines began to appear, about the year 1912, they were all of the compression type operated by electric motors which naturally brought them at the outset into fairly close relationship with the electric utilities. The reasons for the development of the compression type of machine were several,

among which the following are of major importance:

1. The small compression type machine was nothing in principle but a time-tried and proven commercial refrigerating plant in miniature and required no development of the principles of operation. I grant at once that the development of the small compression machine from the mechanical and electrical standpoints has been a difficult and costly process requiring high engineering ability, but as far as uncertainty as to operation, there was none.
2. The absorption type of machine, or in general, those types of machines producing refrigeration by the direct application of heat, were not of much commercial value where the heat would be produced electrically on account of their low efficiency and high cost of operation. Also their method of operation appeared more complicated and was not nearly so generally understood.
3. Electric generating companies were more aggressive in their desire to increase their connected loads than were the gas companies and welcomed more readily any energy consuming devices. This, of course, stimulated the development of motor-driven, household refrigerating machines.

The result of development on the part of the manufacturers and of co-operation on the part of the electric companies and dealers resulted in establishing permanently and on a large scale household refrigeration as we have it today.

Public Has Not Borne Proportionate Development Expense

Note here that the public to date has been educated and trained to the value of mechanical refrigeration, almost entirely by the efforts of manufacturers, central station companies and dealers. One might say lightly that the public has borne the cost, but as a matter of fact, in this development, it has to date borne mighty little of it, nothing commensurate in fact with what it should have borne.

Let us now look at household refrigeration from the standpoint of the gas companies.

It is but natural for any public service company to wish to render every type of service which it can to the community or communities which it serves and it became more and more evident that household refrigeration was a service permanently desired by the people and that naturally a good healthy growth in revenue would result. Therefore the gas companies were confronted with the question, "Cannot we, too, as public utilities, render this service of household refrigeration, and, if so, by what means may this be done and what equipment of satisfactory design and operating characteristics is available for adoption and sale?"

It soon became evident that the gas companies could render the service of household refrigeration and the principles by which it could be accomplished were understood, but when it came to machines which were thoroughly developed and which were obtainable in commercial quantities, there were none.

Note this contrast; the electric central staion companies have gone through a series of years, assisting greatly in creating a demand for household refrigerating machines and always having machines available; the gas companies with this demand for household refrigeration already created but unable up to the present moment to meet it on account of the fact that machines are not available in sufficient quantity. Undoubtedly this condition will rapidly improve—in fact, is improving.

The big point of this is that here is a great demand, already created, and household refrigeration with gas offers one of the great commercial opportunities of today.

What Refrigeration Load Means to Gas Companies

It is of importance to see what the acquirement of a gas refrigerating load means to the gas companies.

1. Any new service which the gas company can render the public means an increase in public good-will and increased revenue to the company.
2. It adds a load on the system which normally has its seasonal peak when the system load tends to be lightest.
3. It represents a new class of service, the supplying of which will require a rather reasonable additional investment in the gas generating plants and distribution systems.

Let us now consider the question of gas refrigeration from the viewpoint of the salesmen who must sell these machines and also from the viewpoint of the purchasers of this class of household machines.

The first question that naturally arises is the question of operating cost of a gas-fired absorption type household machine as compared with a compression type machine driven by the conventional electric motor. The answer to the question is as follows:

If we consider two refrigerating machines, one a compression type driven by an electric motor and the other an absorption type fired with gas, both machines producing exactly the same refrigerating effect and operating under exactly the same conditions and further assume an average rate for gas and an average rate for electricity, the cost for gas will be much less than the cost for electricity. I am assuming here that the compression type machine is operating with an air cooled condenser and that the absorption machine is operating with a water cooled condenser. When the cost of cooling water for the condenser and absorber are added to the cost for gas, the total cost of water and gas for the absorption machine will be about the same or even less than the cost for electrical energy for the compression type of machine.

Noiseless Feature Very Important

The question of noise during operation is a point that is always prominent in the mind of the purchaser. It is a strong point in favor of the gas-fired

machine that it may be made absolutely silent in operation and devoid of any moving mechanical parts with the exception of the automatic gas and water valves. This should prove to be a strong sales argument.

The question always arises as to whether or not it is necessary to discharge the products of combustion through a vent to the outside air and the answer is that it is not. The rate of gas consumption on a household machine is so low that practically no air pollution results.

The question of safety is one that is being much discussed. As a matter of fact, these machines can be and are protected by the most positive safety device known, namely, a silver rupture disc, which in the event of excess pressure, allows the ammonia or other refrigerant to escape to the outside air or to escape into and be absorbed by a volume of water.

The gas-fired machine is perfectly flexible with respect to its method of installation; it may be installed in the box or compartment to be cooled or in some remote location.

The possible freedom from servicing offered by the gas-fired machine is a strong argument in its favor.

As far as first cost is concerned there is no reason why the gas-fired machine should not be sold at the same or a lesser price than a compression machine of equal quality and rating.

Any gas-fired machine must be completely automatic in all details if it is to attain permanent success.

The testing of a new line of machines and a knowledge of their characteristics before promiscuously selling them is of the utmost importance and should be done by persons thoroughly skilled in this kind of engineering work.

The best way to introduce gas refrigeration successfully into any community in the face of electric competition is to have this problem in the hands of and under the guidance of persons thoroughly familiar with all phases of refrigeration so that all types of sales resistance may be adequately and correctly met.

In conclusion it is well to point out again the fact that a gas refrigeration load is well worth acquiring, that enormous opportunities are open in this new field for gas companies, manufacturers and individuals. Many new and radical developments are pending and much may be hoped for in the future, perhaps it is better to say in the near future. There is no doubt that the development, manufacture and sale of household type gas-fired refrigerating machines represent one of the newest and most outstanding group of business opportunities of the present time.

SURPLUS HEAT UTILIZATION POSSIBILITIES IN CANADIAN COAL GAS PLANTS*

W. C. Philpott

Chemist, Consumers' Gas Company, Toronto, Ont

(Concluded from July 9th issue)

It has been proved conclusively that a large modern gas-works fully equipped electrically and having an efficient generating station can, in addition to providing sufficient power for all works purposes from previously wasted heat, have surplus energy for sale.

With existing works full use cannot always be made of the waste-heat steam, owing to disadvantageous methods of application, but undoubtedly it will soon be common practice to so apply the surplus heat from the gas generating plants that fuel fired boilers will be unnecessary, and the addition of a further saleable product in the shape of electricity will be a general matter of fact.

Results in New England

At a New England gas works where the waste heat boiler on the Glover-West plant and the coal fired boiler are of approximately equal size, the following results from October to December, 1926, are of particular interest.

Waste Heat Boiler Plant	Pounds
Total coke used average per day in bench producers	49,000
Coke used in bench producers per 100 lbs. of coal carbonized	13.9
Steam evaporation per lb. of producer fuel.	5.5
Steam production average per day	270,000
Coal Fired Boilers	
Total coal used average, per day	64,797
Steam evaporation per lb. of coal fuel.	7.44
Fuel Saving by W. H. Boilers on Basis of Evaporation per Lb. of Fuel	7.5 Lb.
Average saving per day—pounds of coal fuel	36,000
Equivalent saving per year—tons	6,570
Taking $5 per ton, annual saving would be	$32,850
Coal gas made per day, average through period—M. ft.	2,363
Saving per M. ft. coal gas made—cents.	3.81

By crediting the retort benches with the boiler fuel saved the net amount of coke used per day for the carbonizing process equals 13,000 lbs. and the net amount per ton of coal amounts to only 74 lbs.; 3.7 lbs. per 100 lbs. of coal against the gross figure of 13.9 lbs.

Vancouver and Toronto Results

The following figures relate to the waste heat boiler installations at Vancouver, B. C., and our own plant at Station A, Toronto.

*Read before Canadian Gas Association, Toronto, Can., June 16-17, 1927.

Vancouver, B. C.

This is an installation of two waste heat boilers, one on the original plant and the second on the extension, both Glover-West plants.

Steam evaporation from and at 212 deg. F. lbs. per hour	6,892
Coke used in producers about 28 per cent ash—lbs. per hour	2,750
Steam pressure per square inch—lbs. per hour	125
Saturated steam temperature—deg. F.	400
Steam used in retorts—lbs. per hour	2,750
Retort steam superheated to—deg. F.	550
Saving per year based on boiler fuel saved at $4.90 per net ton	$36,000
Power for fans—K. W. H.	20
Steam evaporation per lb. of carbon in producer fuel—lbs.	3.5

It is to be noted in this installation that the coal carbonized contains 18 per cent ash, which means that the ash in the coke would be nearly 28 per cent. This high ash content would be undoubtedly reflected in a low producer efficiency explaining the somewhat low steam yield as compared to waste heat boilers on other plants of this type of carbonization.

Toronto, Ont.

A recent two-day test on the W. H. boilers at Toronto gave working results as follows:

Coal carbonized—tons	480
Dry coke to producers per 100 lbs. of coal carbonized—lbs.	11.77
Total water evaporated from and at 212 deg. F.—lbs.	589,248
Evaporation per lb. dry coke, from and at 212 deg. F.—lbs.	5.21
Actual steam produced per 24 hours at 110 lbs. pressure—lbs.	535,680
Actual steam per hour at 110 lbs. pressure—lbs.	11,160
Actual steam per ton of coal carbonized—lbs.	1,092
Actual steam at 110 lbs. pressure per lb. of producer fuel—lbs.	4.74
Temperature at inlet of boiler—deg. F.	1,250
CO_2 at inlet boiler—per cent	13.6
Temperature at outlet boiler—deg. F.	430
Feed water temperature—deg. F.	190

Allowing 6 per cent of steam produced for power to operate the fans the above represents a net daily evaporation from and at 212 degrees F. of 552,000 lbs., allowing 7 lbs. of water evaporation per lb. of coke fuel in the main works, the fuel saving amounts to 78,890 lbs. per day, or over 14,000 tons per year.

If the bench producers are credited with the fuel saved, 78,890 lbs. per day, the actual fuel used for carbonization will be reduced from 112,990 lbs. to 34,100, or 71 lbs. of dry coke per ton of coal carbonized; 3.55 lbs. per 100 lbs. of coal.

It is to be noted that the steam used for driving the fan and feed water pumps is largely recovered by the feed water heater. The 6 per cent allowance for fan operation is taken from Mr. Thorman's paper, and while it has not been checked on our own plant, it agrees well with calculations.

The turbine, in other words, acts largely as a pressure reducing valve, the energy of the steam entering the turbine being mostly recovered in heating the feed water.

Possibility of Utilizing Heat From Incandescent Coke

Whilst the foregoing matter has dealt solely with results obtained from surplus heat in continuous vertical retort plants, mention might be made ot possible results in steam generation from the incandescent coke discharged from plants of the intermittent type. As a paper is to be read at this meeting, however, on results at the Rochester, N. Y., works on their dry quenching installation, I will not pursue this part of the subject.

The results from waste heat boilers attached to water gas sets are well known, and there is in Montreal a large installation in the modern water gas plant there. Members of the association were able to inspect this plant at last year's convention.

Finally, it is good to note that gas engineers now realize the great difference between "waste heat" and "wasted heat." A certain amount of heat is unavoidably "wasted"—or might I say it is uneconomical to recover a certain amount of so-called waste heat; but it is now firmly established that the majority of the heat we have looked upon as "waste" should more correctly be termed "surplus."

¤ ¤ ¤ ¤

CALCUTTA SHOWS HOW TO END SMOKE EVIL

Calcutta, capital of British India, has joined with other great cities of the world to put an end to the smoke nuisance, and is fostering the use of gas instead of raw coal with conspicuous results, according to a recent report from Bengal.

Twenty years ago gas was widely used for lighting in Calcutta, but there were in service less than 100 gas stoves or other appliances, and a pall of black coal smoke overhung the city throughout the year.

A recent survey shows more than 10,000 gas appliances now in use in the Indian capital, and an estimate by the Calcutta health authorities attributes to these a decrease of 1,800 tons of soot and 700 tons of sulphuric acid a year in the atmosphere. This decrease, with rigidly enforced laws governing the use of raw coal, have, says the report, cut down smoke pollution approximately 90 per cent.

The burning of raw coal is the chief cause of air pollution in American cities, according to a report of the Bureau of Mines of the U. S. Department of Labor, and is a serious danger to public health.

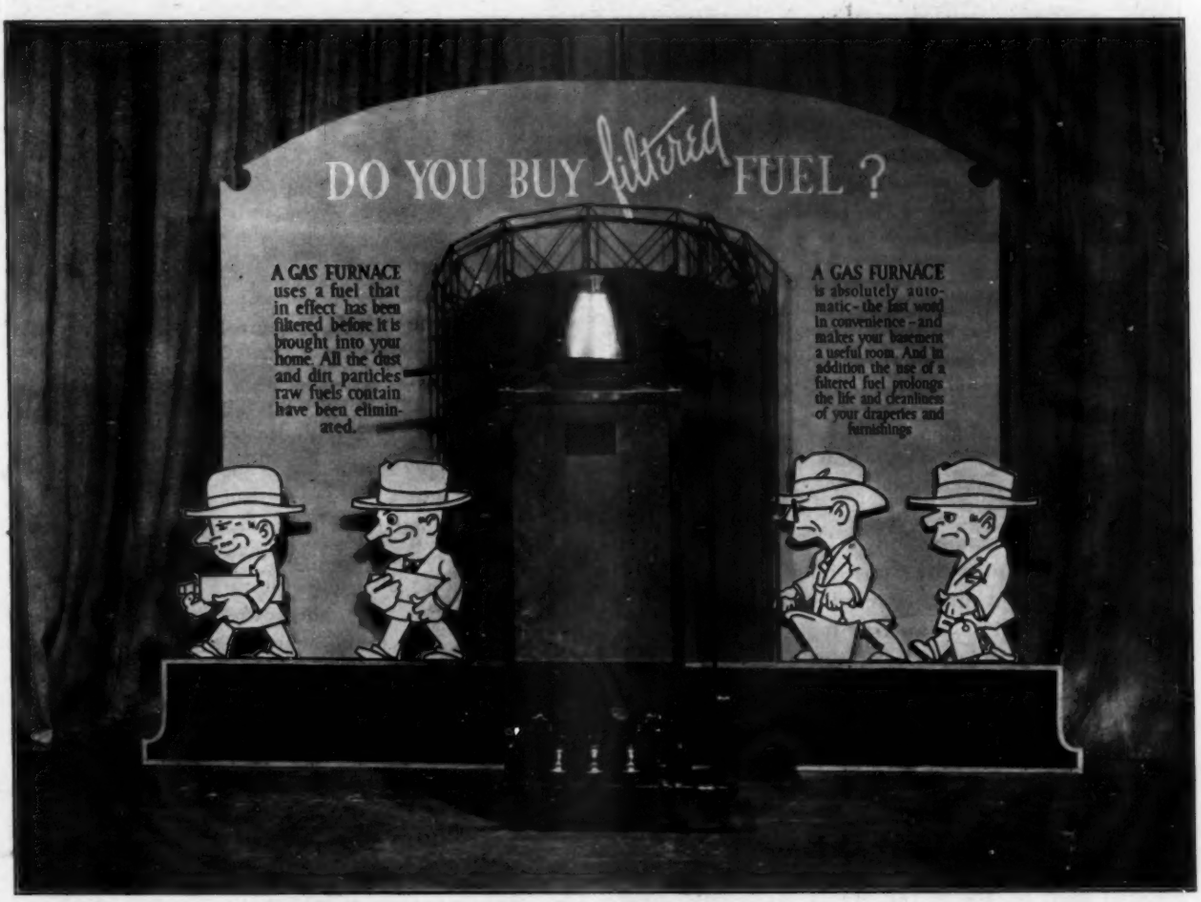
The material damage due to smoke and soot in American industrial cities is estimated to amount to $7.66 per inhabitant a year, says the Bureau. Dr. James E. Ives, of the U. S. Public Health Service, recently declared that smoke and soot in New York City were depriving dwellers there of from 20 to 50 per cent of their sunlight.

WINDOW DISPLAY ADVERTISING

That sells more gas to pleased customers

Ray Martin

Display Manager, Consolidated Gas Company of New York


DO YOU BUY filtered FUEL ?
A GAS FURNACE uses a fuel that in effect has been filtered before it is brought into your home. All the dust and dirt particles raw fuels contain have been eliminated.
A GAS FURNACE is absolutely automatic - the last word in convenience - and makes your basement a useful room. And in addition the use of a filtered fuel prolongs the life and cleanliness of your draperies and furnishings

THE greatest uncertainty seems to exist in the majority of executive minds of the gas industry as to the value of display windows. Literally, only a handful are "sold" on this advertising medium; another small group believes in it, but not whole-heartedly; while the big majority are skeptical. The question is, are the comparative few to be congratulated or are the skeptics simply non-progressive?

In order to determine the exact dollars and cents value of each show window, my suggestion is that one of your employees be commissioned to get an option on one year's rental of some merchant's window in your territory. Of course, a window comparable in size and prominence of location to the one you are experimenting with.

Rentals will vary slightly, and should represent the revenue to be expected from your own windows. In other words, you will know exactly how many dollars are lost each week if your windows are not being used properly.

This particular test is suggested because, obviously, a utility company cannot experiment by renting its own windows to another business enterprise. If it did, the public might some day be startled by a gorgeous display of pink lingerie—not exactly in keeping with the dignity of a utility company.

There is but one solution. Make each window return a profit by installing window display advertisements that sell more gas to pleased customers. As soon as the gas industry, as a whole, realizes the actual commercial value of its windows and uses them to sell gas service rather than to show appliances, this inexpensive advertising medium will be at a premium.

As The Journal Views It

OUR NEWEST APPLIANCE AND PUBLICITY

It has been variously estimated that within a few years the electrical industry will have sold in excess of ten million refrigerators. This will be largely due to the publicity and intensive advertising efforts the manufacturers are putting forth.

One might inquire as to whether the gas-fired refrigerator will enjoy any such prolific sale without a similar advertising campaign. Despite its technical and operating advantages, we do not believe that this will be the case unless a heavy publicity effort is undertaken.

The industry would do well to bear in mind the altogether tremendous part that gas refrigeration can play to bring it closer, if possible, to its customers. In this connection it is but necessary for one to make inquiry of those housewives who are enjoying the convenience and benefits of electrical refrigeration. Almost invariably they laud the appliance with a maximum of enthusiasm, and the question of operating cost is often entirely disregarded. However, if it should appear a trifle out of line the housewife will many times excuse such a condition by way of a quite valiant exposition of its merits and convenience.

When such a state of affairs obtains, it cannot be denied that the electrical industry is occupying a place of high regard in the minds of its customers. Aside from any consideration of revenue obtained from the sale of power to operate the refrigerators, it has undoubtedly acquired a great moral impetus from the self-same customers.

All of such advantages can be enjoyed by the gas industry. For that matter, it is highly possible that they can be indulged in to a greater extent than our electrical competitors. To arrive at any such happy juncture several factors and conditions must be appreciated and reckoned with.

The gas industry as a whole must give secondary consideration to the matter of the cost of operation of the gas-fired unit except insofar as it would link in with any publicity program.

It must make the proposition of revenue derived from the sales of gas subservient to the great convenience and health benefits it is furnishing the public.

It must work out some kind of going scheme, on a large plan, for giving the gas-fired refrigerator the advertising and publicity that is due it.

This latter phase is the most important because it involves the expenditure of large sums of money. The same must come from somewhere, either the manufacturer or the gas company or both. At all events, it is the prime essential for the success of gas-fired refrigeration.

¤ ¤ ¤ ¤

BUSINESS AS USUAL

The Chamber of Commerce of the United States, with the co-operation of a group of business executives, has made a survey of the present status and the trends of business. This same group of business leaders forecast satisfactory conditions for 1927 when consulted at the beginning of the year, and now at the mid-year point they say that nothing has happened to make them change their opinions concerning the last six months of the year. This is good news to the gas industry, for its business inevitably grows or ebbs with the corresponding changes in general business conditions. Apparently we can safely count upon a prosperous Fall and Winter season, for these prophecies are dependable.

During the low-load period of the Summer, therefore, each manager should look over his plant and distribution system carefully, in anticipation of a greater send out next Fall than has been experienced at any time previously. And among the plans which should be made are those for further increases in the industrial part of our business. The effort to gain increase of industrial-gas sales must be relentless. These sales are the back log of our business. If we do not maintain a steady growth in industrial output we shall be confronted with constantly decreasing load factors as the result of the unsought, and often unwanted, increase in house heating by gas. The industry cannot afford such retrogression and need not experience it, for "business as usual" means a constantly growing opportunity for year-round industrial gas sales and the consequent bettering of our seasonal load curve.

INDUSTRIAL GAS LESSONS

IF IT'S DONE WITH HEAT YOU CAN DO IT BETTER WITH GAS

Lesson No. 178
Carburetted Blue Gas

IT has been explained that the carburetter is a vertical steel cylinder which is filled with checkerbrick. It is provided at the top with an oil spray which has been explained to be made in different forms. The oil is sometimes admitted with the admixture of steam, the steam effecting the proper spraying of the oil, but most plants use compressed air for this purpose. Sometimes the top of the carburetter—and this pertains to the superheater as well—is made in the form of a dome, but most always it is provided with just a flat top.

The superheater is the next piece of apparatus in the carburetted blue gas plant. It is also a steel cylinder which is anchored to a bed of masonry or concrete. The superheater is, however, generally about one-third higher than the carburetter. The superheater is lined with firebrick as well as an insulating layer of asbestos. The superheater is also generally filled with checkerbrick for the greater portion of its height.

Superheater and Carburetter Connections

The superheater and the carburetter are connected at the bottom by means of a fire-brick lined passage. The stack is a short section set on the superheater. The gas take-off from the superheater goes not to the scrubber, but first to a separate seal pot. The tarry vapors in the gas have a tendency to separate out in the take-off pipe, and for this reason this pipe is made short, so that it may be easily cleaned. The construction of the seap pot or wash box has been explained in the lessons which were concerned with the manufacture of blue gas and need not be repeated here.

While we are on the subject of the construction of the carburetted blue gas apparatus, it is essential to mention that there are a number of special connections for introducing air into the carburetter. This air is generally known as secondary air or the carburetter blast, and is for the purpose of insuring complete combustion of the blast products that are formed in the blasting of the generator and which when more completely burnt in the carburetter cause that apparatus to be heated up to the temperature that is best suited for the cracking of the gas oil. It is also common practice to introduce air into the superheater for the purpose of completing the combustion of the blast products in that apparatus in case complete combustion has not been attained in the carburetter. However, it is sometimes questionable whether or not this is good practice, for the reason that the blast gases contain but little combustible matter when they reach this apparatus and this may lead to the uneven heating of the superheater. It of course understood that the carburetted blue gas set can also include a waste heat boiler for the purpose of producing low pressure steam from the considerable amount of sensible heat that is still in these gases.

The Instruments

The instruments that are used on the carburetted blue gas set are of the utmost importance and without them it would be hopeless to secure efficient operation of the apparatus. Thus there are generally two pyrometers which are used for controlling the heat of the checkerbrick in the carburetter and the superheater. One of these is usually inserted at the bottom of the carburetter and the other at the top of the superheater. These pyrometers are preferably of the recording type, and this applies as well to many other instruments that are employed around the gas works, for when these instruments are of that character, then a permanent record is available of the variation in the temperatures, which is of considerable value.

The modern carburetted blue gas set is also provided with automatic controls. It is not possible here to spend any time in describing this complicated but exceedingly useful apparatus, but it may be mentioned that there are four principal types and that they all have for their purpose the elimination of the element of uncertainty that is always present in hand control. They open and shut the various valves at the proper intervals and there is no loss in time, which often happens with hand control. Furthermore, they effect a saving in labor due to the elimination of hand control, and they are always provided with devices for hand control should the mechanism go wrong at any time.

GAS MERCHANDISING

Domestic – Industrial

Ideas for the Man Who Sells

William H. Matlack

EXEMPLIFYING THE "PSYCHOLOGICAL MOMENT"

J. B. Dillon

On June 1 and 2, late in the afternoon, Denver, Colorado, had rain and hail, the hail on the third causing one-half million dollars damage, riddling greenhouses, residences, automobiles, killing dogs, wounding pedestrians, etc., and on June 4 and 5 the newspapers are filled with insurance advertisements covering hail damage, and then comes the various roofing material men with "hail-proof" roof advertisements. This is catching the people when they are inclined to be caught. The gas company advertised as follows:

IT'S HAIL PROOF!

We Guarantee That

A Crown Brand
Pitch and Gravel Roof

CROWN TAR WORKS
Public Service Company of Colorado

¤ ¤ ¤ ¤

REFRIGERATION

The gas men in the Middle West have opened up their refrigeration campaign with a bang. The Laclede Gas Light Company, St. Louis, opened up with a full page advertisement in the newspapers and are also sending out direct mail advertising of their own design and conducting demonstrations on their Home Service Gas Refrigerator in the Home Service Auditorium daily. The whole page advertisement, reproduced on this page, literally swamped the company with inquiries. The Illinois Power and Light Corporation, over in Illinois, is also merchandising gas refrigerators.

The GAS REFRIGERATOR IS HERE!

At last a refrigerator has been perfected that preserves all foods in an even constant cold without dependence on any mechanical means of operation—no machinery whatever to get out of order!

It is the HOME SERVICE Gas Refrigerator, recommended and guaranteed by The Laclede Gas Light Company. Years of continuous scientific experiment have made possible the development of gas refrigeration which foremost engineers recognize as the coming method of food preservation. There is no other refrigerator made that is so simple of construction and operation and at the same time so completely dependable and adequate. The Gas Refrigerator provides absolute protection of health, foods—constant dry cold—prepares chilled, frozen and jellied delicacies, and supplies ice for table use. It has no moving parts, nothing to get out of order. It is automatic, noiseless, economical.

Mail the Coupon | *18 Months to Pay*

The LACLEDE Gas Light Company ~ Olive at Eleventh ~ CEntral 3800

¤ ¤ ¤ ¤

HOUSE HEATING

One of the companies that is getting results in the house heating field tell us that they get best results from newspaper advertisements run in the morning newspaper. These ads. are brief and usually end with the suggestion that the gas com-

pany's house heating engineer be called upon for facts and figures. The theory is that when a fellow has been down in the basement and had a tussle with the coal fired furnace before he has consumed his morning cup of Java that he is in a pretty receptive mood—"anything," he says, "at any price to get rid of this morning harrow." Don't it sound reasonable—make that house heating ad. brief and to the point. You will be able to get copy angles early in the morning from most any man—try it!

☼ ☼ ☼ ☼

THIS PLAN GETS BONA FIDE APPLIANCE PROSPECTS

Little Rock Gas Appliance Company Makes House-to-House Inspection and Learns Some Surprising Things About Sales Possibilities

Ruel McDaniel.

WHEN the outside salesmen of the Little Rock Gas Appliance Company, of Little Rock, Arkansas, go out and call upon a prospective customer now, they know that they are not stalking up a blind alley. They have bona fide evidence that the person upon whom they are to call is a live prospective purchaser of a gas range, a heater, or some other household appliance.

Conditions have not always been thus. Not so long ago the salesmen were confronted with the for making an inspection of the appliances in use or problem of gaining admittance to the homes, either taking the housewife's word for their condition, and then, providing the evidence warranted, beginning the sales talk. It was a long way around.

Advertising, of course, brought in a number of inquiries and prospects; a few people voluntarily came to the sales rooms and asked to be shown certain appliances, but the company knew that in house-to-house selling lay the backbone of the retail business. Getting good prospects was the thing.

They resorted to a house-to-house inspection plan to get the kind of prospects they wanted—and they got them galore!

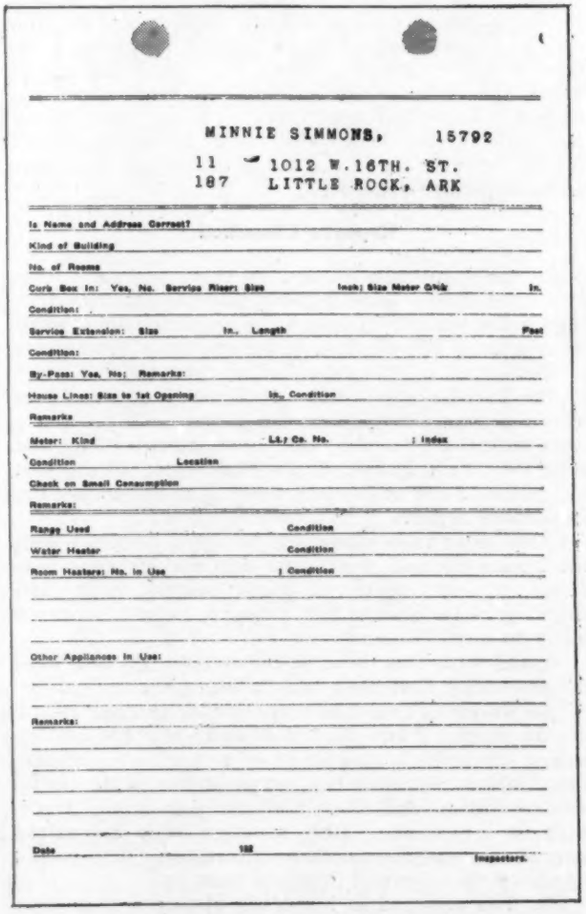
"Finally hitting upon the idea of house-to-house inspection," explained Arthur H. W. Cayhue, manager of the company, "we immediately printed up a large number of sheets of paper for the purpose. We had these punched at the top so that they would be easy to file, and we left ample space for names and addresses at the top.

"This company is the selling agency of the Little Rock Gas & Fuel Company—the public service gas company here—so we had these sheets sent over to the mailing department of that company and had them run off the names of all gas users on to the sheets by the aid of their addressograph. It required only a short time to do this, as all names were set up and ready to run at any time."

Sheets Tell Whole Story

Then, Mr. Cayhue further explained, a force of inspectors, bearing badges from the public service concern, each took a certain section of the city and visited every person whose name appeared on the rolls of the gas company.

Without misleading the gas users in any way, the inspectors presented their badges, told the housewives that they were making a survey of appliances on the gas company's lines, and asked permission to see the kitchen. Housewives, sensing the authority



MINNIE SIMMONS, 15792

11 1012 W.16TH. ST.
187 LITTLE ROCK, ARK

Is Name and Address Correct?
Kind of Building
No. of Rooms
Curb Box In: Yes, No. Service Riser: Size Inch; Size Meter Cock In.
Condition:
Service Extension: Size In., Length Feet
Condition:
By-Pass: Yes, No; Remarks:
House Lines: Size to 1st Opening In., Condition
Remarks
Meter: Kind Lt.; Co. No. ; Index
Condition Location
Check on Small Consumption
Remarks:
Range Used Condition
Water Heater Condition
Room Heaters: No. in Use ; Condition
Other Appliances in Use:
Remarks:
Date 192 Inspectors.

in the visit, admitted the inspectors without further question and they were allowed to complete their surveys unmolested.

On the other hand, if the caller had been a salesman from the appliance department he probably would have had difficulty in gaining admittance at all. Then if he had said that he would like to look over the appliances in use to see their condition, the housewives probably would have told him that the appliances were all right—in fine shape. And the housewives probably would have been honest in their statements, for it naturally requires a practical knowledge of appliances to tell their true condition. The old ways would have let many excellent prospects slip through the salesmen's fingers in various ways.

First of all, the inspector checks the slip he has on this particular customer to see that the name is

spelled correctly. Then he notes the sort of building she lives in and the number of rooms; reports as to whether or not a curb box is in, the size of service riser and meter cock, and their condition; length and size of service extension and its condition; size of first opening in house lines and their condition; he writes down the kind of meter he finds in use and its condition and location. In a section set off to itself on the sheet by double lines the salesman writes down the kind of range he finds in use and its condition; the kind of water heater and its condition; the number of room heaters in use and the condition they are in. There are then blank spaces below this data for the salesman to write down the names of any other appliances he finds in the house, and still further down the sheet are several lines for his remarks as to the value of the gas customer as an appliance prospect.

Reports Classified

As the inspectors turned in their reports to the office the sheets were immediately classified according to the kind of prospect the gas customers were. At a glance Mr. Cayhue could see by a description of the house, as to size and kind, and the condition of the various appliances, whether or not the user was a prospect for a new appliance. All prospects were assorted from the total of sheets turned in, and then they were further divided according to the sort of appliance the customers needed, as shown by the inspectors' reports.

Cards were then made out for each person whom the sheets showed were prospects for either a new range, a water heater or room heaters, each card showing what article the prospect would be most likely to buy.

Armed with this data, salesmen now go out with the assurance that they are calling upon only those people who really need new appliances and can afford to buy them. They do not have to ask the housewife if she needs a new range or a new water heater. They inform her that her range or her heater is in poor condition and that it would pay her to trade it in on a new one. She wonders how the salesman knows and she becomes interested. The salesman is on the offensive from the start.

The idea resulted in hundreds of names that represented prospects of the very highest type; and the added efficiency of the outside men, aided by the data, is worth many times the cost of the inspection, Mr. Cayhue declared.

Churches as Prospects

Another plan that has served to bring considerable extra business to the company is an offer which they recently made to churches in and near Little Rock.

In the fall, when Mr. Cayhue visited the state fair at Little Rock he noticed in the various booths fitted out by the churches in the city that the ranges they had in use were as a rule rather dilapidated. He concluded at once that the churches ought to have new ranges for use in their various social and charitable activities.

Accordingly, he wrote letters to all the pastors in the city, offering to give to any church whose members purchased as many as 12 ranges from the company a brand new range. The range given to the church would be of a quality equal to the average purchase of the 12 members. The range of the church could be put to any use its members saw fit. He suggested that it might be of use in the parsonage.

He mailed a similar letter to the various ladies' aids in the city. With each letter, which was personal, he enclosed a government postal card, addressed to the company, upon which the recipient of the letter could signify his or her interest in the proposition.

The offer created considerable interest among church people and not a few churches accepted the proposition. The gift of one range out of twelve was not costly advertising, and a great deal of goodwill resulted from the plan.

¤ ¤ ¤ ¤

UTILITIES LEADING OTHER INDUSTRIES IN NEW FINANCING

The public utility industry leads all other industries in the amount of new money secured for service improvements and extensions from the sale of securities in the first five months of 1927, ending May 31. The total amount of new public financing, secured from employees, customers and the general public was $908,757,005, as compared with $838,398,932 in 1926 and $363,772,536 in 1923, five years ago.

The figure for the first five months of 1927 compares very favorably with the total figure of new finacing by utilities in 1926, when the utilities also led all other industries with $1,604,000,000. With an extension of the good business conditions prevailing in the first part of the year, there is every indication that the total for the year 1927 will set a new high record.

"The phenomenal growth of every branch of the utility industry is reflected in the new financing figures," say the American Gas Association. "The development of large-scale uses of gas for house heating and for industrial heating operations is responsible for the splendid showing made by this branch of the utility family. The solution of long-distance transmission of gas at high pressures, predicted by some gas engineers, will bring a further increase in gas sales, when gas service is brought to many small communities that are without this modern service today.

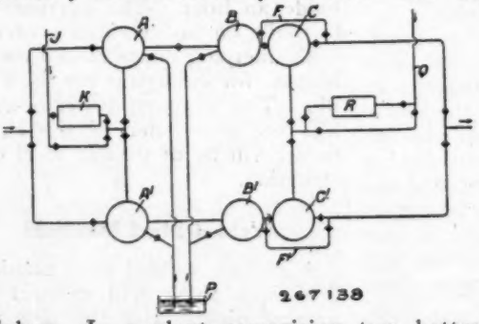
"The other branches of the industry are also enjoying parallel growth, and it can safely be said that never before have the utilities been in better condition."

The Association believes that the faith of the public in the utility industry as a sound business is best shown in the ever-increasing sales of securities to employees and customers.

PROGRESS IN GAS TECHNOLOGY
Domestic and Foreign

DESULPHURIZING GASES

DISTILLATION and other gases are passed through a series of purifiers, which are maintained at a temperature, such as 250 degrees C., sufficiently low to preserve the chemical equilibrium of the purified gases, in order to remove separately and successively "mineral" and "organic"



sulphur. In a plant comprising two batteries A, B and C, and A^1, B^1 and C^1, as shown in the accompanying illustration, for alternate use to permit of regeneration the first purifiers A and A^1 may be charged with finely divided oxides of nickel on a support of porcelain, clinker, pumice stone or porous earth, and the second purifier B and B^1 with oxides of copper or iron. A third purifier C or C^1 with a similar charge to that of the first is included if the gases contain steam, since by the action of steam on the metallic sulphides formed in purifier B or B^1, sulphuretted hydrogen is reformed.

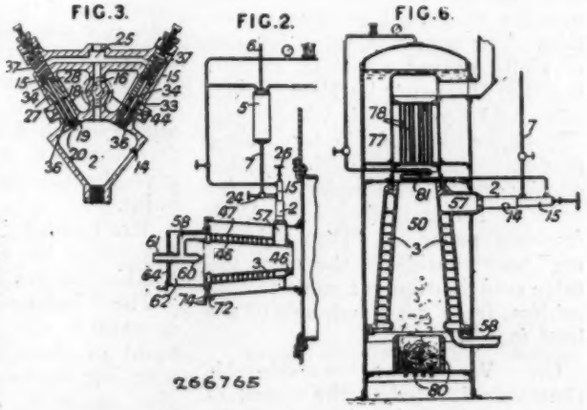
Regeneration may be effected with the aid of air or water gas charged with steam. This the purifier A or A^1 is subjected to an air current from a heater K, to which a supply line J is connected, while the purifiers B, C or B^1, C^1, are subjected to a water gas-steam current from a heater R, which is maintained at a temperature of 350 degrees C, to which a supply pipe Q is connected. The sulphur dioxide leaving the purifier A or A^1 and the sulphuretted hydrogen leaving the purifiers B, C, or B^1, C^1, are passed to a water vat P. British Patent No. 267,138.

¤ ¤ ¤ ¤

OIL GAS

GAS is generated from liquid hydrocarbons by forming a mixture of the hydrocarbon with an atomizing agent, and introducing a decarbonizing agent such as steam into the mixture, which is then allowed to expand and is passed through heated passages, which may have a catalytic effect, the result gas being led to a burner or gas holder. Oil from a pipe 6 is heated in a steam heater 5 and passed by a pipe 7 and valve 24 to nozzles 15 delivering into a fan-shaped mixing chamber 2, to which steam is supplied from a pipe 25 and central nozzle 16. Each nozzle 15 comprises a cylindrical casing 18, which contains a member 27, the central portion 28 of which is a close fit and serves as a piston, one face 33 of which is subject to the oil pressure, and the other face 34 to steam pressure, a spring 37 of adjustable tension pressing the conical end 36, in which is a steam discharge opening 20, against the seating 19 in the chamber casing 14.

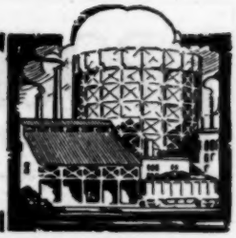
FIG.3. FIG.2. FIG.6.



When oil and steam valves 24 and 26 are opened, the mixed fluids flow into the mixing chamber 2, but when the valve 44 of the central nozzle 16 is opened the pressure on the member 27 is relieved and the oil inlet between the conical ends 36 and 19 is widened so that the amount of steam supplied to the chamber 2 can be increased until a surplus of steam is present. The mixture then enters an expansion chamber 57 leading to a gasifying chamber 3, which is formed by conical members 46 and 47, external ribs on the member 46 engaging the member 47 to form a spiral passage 3. The members 46 and 47 are made of chromium nickel alloy and exert a catalytic action, preventing the deposition of carbon and promoting the formation of methane.

The gas is led by a pipe 59 to a burner nozzle 60, a pipe 61 leading to a gas holder. Aid for combustion is supplied through louvres 64 in a casing 62 and a further supply is admitted through adjustable openings 74 in a ring 72. In producing gas for storage purposes only, heat is supplied by a furnace 80, the hot gases from which heat the retort 50 and also fire tubes 78, which generate steam in a boiler 77, this steam being superheated in a coil 81 before reaching the nozzles 15. British Patent No. 266,765.

NEWS OF THE GAS INDUSTRY



Michigan Gas Association Holds Successful Convention

Upwards of five hundred persons were in attendance at the annual convention of the Michigan Gas Association at Mackinac Island July 5-7.

The consensus of opinion was that this was the most successful meeting ever held by the association. The program went off successfully as per schedule, excepting that the paper by Miss Lauder was held over until Wednesday The paper by Prof. Keeler showed that undoubtedly many interesting developments are imminent in the field of refrigeration. Mr. Wolfenden's paper on "House Heating" was considered the most notable contribution yet made to that subject, from the standpoint of the load factor.

On Wednesday considerable time was devoted to the report of the committee in charge of the fellowship maintained by the association at the University of Michigan.

On Thursday morning there was the joint session of both associatiohs, the feature of which was an address by Commissioner Doyle and a very interesting paper by Prof. White.

Major Forward attended the convention and briefly addressed the opening meeting. The joint banquet was attended by 450 persons and was greatly enjoyed.

Mr. C. W. Tippey, vice-president of the Consumers Power Company, acted as toastmaster and Mr. E. W. Hodges, of Henry L. Doherty & Co., was the principal speaker. More than one-third of those present were ladies.

Election of officers for the ensuing year resulted as follows:

President: F. W. Steere, formerly of Detroit, now of New York City.

Vice-President: R. H. Lawlor of Jackson.

Secretary - Treasurer: A. G Schroeder, of Grand Rapids.

In electing Mr. Steere as president the association departed from its usual custom in choosing an operating man. It was the desire to honor a Michigan man, who has contributed and is contributing greatly to the advancement of the industry from the construction and research departments. It was felt that his administration will give the association a new viewpoint.

Mr. Lawlor is general superintendent of the Gas Department of the Consumers Power Company.

The Time and Place Committee expressed the unanimous sentiment of those present in recommending that next year's convention again be held on Mackinac Island.

* * *

Semet-Solvay Engineering Corp Begins Work on Welded Steel Purifier and Washer at Atlantic City

Atlantic City, N. J.—The Semet-Solvay Engineering Corporation of New York has begun work on a welded steel purifier and a multiple washer for the Michigan Avenue station of the Atlantic City Gas Company. The purifier will be 48 feet wide, 120 feet long and 13 feet deep. It is understood to be the largest one yet built entirely by welding. It will have three compartments and ground space has been reserved for adding a fourth when needed. The apparatus will be capable of handling upwards of 450,000 cubic feet of water gas an hour.

A number of features in design make the installation unique. The equipment, first of all, is being built for high speed operation. A test pressure of two and one-half pounds per square inch is specified for the purifier. The gantry crane, which will operate the doors, will carry an oxide elevator and screw conveyor and will be able to handle 2,000 cubic feet of oxide an hour. The purifier will be built on an elevated structure with dumping doors placed on the bottom for emptying the used oxide. The supporting framework like the remainder of the equipment, will be of welded steel construction.

Welded Steel Manifold

A 24-inch welded steel manifold 5-16 inch thick will connect the present piping with the new unit and will supply gas to any of the three compartments or all of them in series, or will reverse the direction of gas flow through the layers of oxide.

The foundation design calls for a structure sufficiently strong to withstand a 100 - mile wind Whether this is required because of the danger of tornadoes or to resist the blasts of convention oratory, so abundant at Atlantic City, has not been made clear. Steere-built welded equipment has already been assailed by the elements.. A welded steel purifier went through the Miami hurricane and a washer cooler stood up through a tornado in Havana, although surrounding buildings were leveled.

The multiple washer, capable of removing impurities from 10,000,000 cubic feet of gas a day, will be built in two complete units, each 9x10 feet, of double deck design and operating in parallel. This will enable the company to have equipment of the needed capacity with a minimum of ground space used. Like the remainder of the apparatus, there will be no rivets in the construction of this multiple washer, it being completely welded.

Commission Approves Schedules of Rates of Pavilion Natural Gas Company for Supplying Mixed Gas

Albany. — The Public Service Commission has approved tariff schedules and the rates and charges contained therein, filed by the Pavilion Natural Gas Company of Pavilion, Genesee County, for supplying mixed gas to the public and to the Tri-County Natural Gas Company, in Avon, Mt. Morris and other villages and towns in Livingston, Genesee and Wyoming counties, without prejudice to further investigation either on complaint or on the Commission's motion and without prejudice to suspension, change or rejection.

New rates are to become effective July 1, 1927, and to remain in force until the further order of the Commission and all revenue derived from increased rates, above legitimate operating expenses and taxes, will be impounded by the company to await the further order of the Commission. The Company is further directed to file with the Commission not later than February 1, 1928, a detailed statement of its operations under the revised rates.

On April 30, 1927, this company filed tariff schedules for new rates. The present rate for natural gas fixed by order of the Commission, is 80 cents per 1,000 cubic feet with two cents discount per 1,000 cubic feet for prompt payment. Its supply of natural gas has been diminishing and it recently has installed new equipment and is now furnishing mixed gas. The proposed rate is $1.50 for the first thousand, $1.25 for the next four thousand, $1 for the next five thousand and 80 cents for all over 10,000 cubic feet, with a monthly minimum charge of $1.

The company also furnished gas to the Tri-County Natural Gas Company at 50 cents per thousand cubic feet, which it proposes to increase to 75 cents. It claims a rate base of $1,275,000 based on reproduction cost, new, less depreciation, and that its present rate would produce a return of less than 4 per cent. At the hearing it was stipulated by the parties interested that the rates be permitted to become effective on July 1, 1927, and that the company file a statement of actual operation results on or before February 1, 1928, and in the meantime that all revenue over and above operating expenses and taxes be impounded. The municipalities also reserved the right to further investigate and contest the reasonableness of the rates.

Cast Iron Pipe Publicity Bureau Changes Name to "The Cast Iron Pipe Research Association"

This change in name of the association was actuated by the fact that the principal functions of this organization is research and not publicity.

Mr. Thomas F. Wolfe, who was for some time one of the city engineers in Chicago, devotes most of his time to research and in collecting and distributing information relative to cast iron pipe for all purposes. The advertising is prepared by the agency under the personal advice and direction of Mr. Wolfe, who is the point of contact between the agency and the advertising committee of the association.

One of the objectives of the advertising campaign is the stimulation of interest in small towns that have no waterworks, in the importance of having a modern waterworks system.

The association itself has, of course, nothing to sell. When interest in a community reaches the point where action on a waterworks system is to be taken, the information is passed out to the different manufacturers of cast iron pipe and the matter is then left to their representatives to handle.

The association also advertises extensively in the technical magazines and along educational lines in the technical college publications.

A. L. Hollinger Takes Charge of Pittsburgh Office of Surface Combustion Company

Mr. A. L. Hollinger took charge of the Pittsburgh office of the Surface Combustion Company of New York July 15, succeeding Mr. F. J. Winder, who left to take up work with the Allegheny Steel Company, where he will be assistant to the general manager in charge of fuel.

While in charge of the Pittsburgh office of the Surface Combustion Company Mr. Winder raised its sales volume from third to first place among the branch offices.

Mr. Hollinger has had charge of the Chicago office of the Surface Combustion Company for some years, and will be succeeded by Mr. G. B. Ruby.

O. R. Olsen, who formerly did engineering and sales work for the W. N. Best Company and more recently for a mid-western furnace company, has also joined the Pittsburgh staff.

* * *

Recent Government Publications

Prices indicated are charged by the Superintendent of Documents, Washington, D. C., for pamphlets. Send cash or money order; stamps and personal checks not accepted. When no price is indicated, pamphlet is free and should be ordered from Bureau responsible for issue.

Identification of Oil - Field Waters by Chemical Analysis, by C. E. Reistle, Jr. Bureau of Mines Technical Paper No. 404. 5 cents

Petroleum Refinery Statistics, 1916-1925, by G. R. Hopkins. Bureau of Mines Bulletin No. 280. 30 cents.

Safety Rules for the Installation and Maintenance of Electrical Supply and Communication Lines comprising Part II of the Fourth Edition National Electrical Safety Code. Bureau of Standards Handbook No. 10. 60 cents.

Sales of Native and Manufactured Asphalts Increased in 1926 Statistical statement from Bureau of Mines dated May 24.

Carbon Black Production Increased and Sales Decreased in 1926. Statistical statement from Bureau of Mines dated June 2.

Contracts Received by Gas Machinery Company

Knoxville, Tenn. — The Knoxville Gas Company has awarded a contract to the Gas Machinery Company, Cleveland, Ohio, for a six-foot blue water gas set and a seven-foot blue water gas set, complete with igniter, waste heat boiler, turbo blowers, generator charging equipment and overhead brick operating floor. The contract also includes carburettor, superheater, seal-separator, oil pump and auxiliary equipment, so that carburetted water gas can be made on the seven-foot generator, if desired.

The equipment is operated by hand hydraulic control and the contract also includes a cooling scrubber and connections.

The gas company has raised the side walls and roof of a retort house, to house the new machinery which will serve to take care of the growth of Knoxville and the increased demand made on the plant.

Mt. Clemens, Mich. — The Gas Machinery Company have received a contract for new purifying equipment to be installed in the gas plant at Mt. Clemens. This new purifying equipment will be located out of doors and will be of the latest and most improved type.

Waukegan, Ill. — The North Shore Gas Company has awarded a contract to the Gas Machinery Company for a six-foot diameter by fifty-five-foot high cooling scrubber complete with wooden tray filling and twenty-four-inch gas by-pass, valves and connections, including piping from the relief holder to the scrubber by-pass.

This new installation will be complete with cooling coils and pumps as well as with water and liquor piping, and will be erected complete by the Gas Machinery Company.

Jefferson City, Mo. — The Gas Machinery Company are furnishing a new six-foot water gas generator and auxiliary equipment to be installed at the gas plant at Jefferson City, Mo.

Unique Honor Paid Mr. F. W. Steere

Mackinac Island, Mich.—F. W. Steere, of New York, vice-president of the Semet-Solvay Engineering Corporation, formerly the Steere Engineering Company of Detroit, was elected president of the Michigan Gas Association at the annual convention of the association here.

F. W. Steere

This is the first time in the history of the Michigan Gas Association that a citizen of another state has been elected president of the organization.

Mr. Steere is the inventor of the "back-run" process of making water gas, and has perfected a number of other improvements in manufactured gas plant equipment.

This new six-foot water gas equipment will be installed alongside of the six-foot water gas set erected in the gas plant at Jefferson City, Mo., by the Gas Machinery Company several years ago, and will give the gas company a duplicate size of generating equipment which will enable them to continue the excellent service to their consumers.

A Directory of Laboratories

In recognition of the desirability of independent commercial testing service in both domestic and export trade, there has been compiled by the Bureau of Standards a list of laboratories that are prepared to test various kinds of commodities to determine whether or not they comply with purchase specifications.

In accordance with the law the Bureau of Standards makes tests and carries out investigations for other government departments Because of the large amount of official work, it is impracticable for the bureau to make tests for private individuals if other laboratories can do the work. To inform interested persons of the location of other laboratories, the bureau has compiled a list of the 207 commercial testing laboratories throughout the country, together with indications of the types of commodities which they are prepared to test. Special care has been exercised to make this list complete.

To accompany the list of commercial testing laboratories there has been compiled a list of 143 colleges which are used not only for the purposes of instruction, but also to a considerable extent for research work. In fact, many important industrial research problems are being solved in the college laboratories.

Copies of any of the 48 lists of manufacturers, to which additions are being made from time to time, can be obtained upon request. Copies of the Directory of Commercial Testing and College Research Laboratories, Bureau of Standards Miscellaneous Publication No. 90, may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C.; price 15 cents.

* * *

Oak Harbor Gets Gas

Oak Harbor.—The Oak Harbor Council has granted the Ohio Fuel & Gas Co., of Columbus, a franchise here. The company will accordingly install and operate a gas line Other towns in the locality are dickering for service.

WILL BUILD PIPE LINE

Natural Gas Application Filed with P. S. C. by Doherty Interests

Topeka, Kan. — Application was filed with the State Public Service Commission by the Henry L. Doherty interests asking permission to secure right of way and construct a pipe line for natural gas that will be brought to this state from the Amarillo, Tex., fields. The pipe line will be constructed and operated by the Kansas-Texas Company, a subsidiary of the Empire Gas and Fuel Company and the Kansas Natural Gas Company, both Doherty holdings.

The pipe line will cover a distance of between 500 and 600 miles. It will convey gas from the Amarillo district to the Kansas territory and will supply all of the major towns now served by the Doherty interests. The right of way has not been definitely selected and until all leases are closed, no decision will be reached as to the point in Kansas where the Texas line will tap the main Kansas Natural line, which now brings gas from southern Kansas and Oklahoma fields.

* * *

Peoples Gas Light & Coke Co. of Chicago Helps Maintain Outing and Recreation Bureau

Chicago.—If picnics are well planned the consumption of gas before they leave home is increased. The Peoples Gas Light & Coke Company of Chicago is one of the concerns which have united to maintain the Outing and Recreation Bureau at 72 West Adams Street, Chicago. This is, it is announced, a service for planning vacations and outings for the thousands who do not own automobiles and for the automobile owners "who are tiring of the endless traffic lines on the highways." Allied with the Peoples company are electric power and railway and motor coach companies of the Insull group.

Interesting and generous (four full columns) newspaper advertising is used. This advertising is made attractive by illustrations of outdoor activities. Beneath each picture is a question; all have the same answer. Like: "Where are best picnic spots affording fun for the youngsters and a good time for their parents? Ask the Outing and Recreation Bureau."

A key into which is inset a panel containing the words "Ask Us!" is also featured in the advertising.

A prominently displayed paragraph solicits motor coach and railway business from clubs churches, lodges and other large groups.

* * *

City of Pryor May Purchase the Pryor-Choteau Gas Plant

Pryor, Okla.—The City of Pryor has made the trustees of the John I. Begg's estate, who own the Pryor-Choteau gas company, a proposition to take over the franchise and business of the company and the proposition has been practically accepted by the trustees, the price to be paid being $115,000 However, before the deal can be made it will be necessary that the city call an election so that the taxpayers may vote upon the matter and in all probabilities this will be done in the very near future.

* * *

Commission Approves Tariff of Rochester Gas & Electric Corporation

Albany. — The Public Service Commission has approved a tariff of the Rochester Gas & Electric Corporation making new rates and regulations for gas service in the village of Webster and town of Webster also applicable to customers in the towns of Brighton, Perinton and Webster who are served or who may hereafter be served directly or from extensions of the so-called "Webster High Pressure Line." Effective June 25, 1927.

Convention Calendar

September

12-16—Pacific Coast Gas Association. Annual convention, Hotel Casa del Ray, Santa Cruz, Cal. Clifford Johnstone, executive secretary, San Francisco, Cal.

Washington Gas Valuation Starts

Valuation of the properties of the Washington Gas Light Company and its subsidiary, the Georgetown Gas Light Company has been undertaken by the Public Utilities Commission of the District of Columbia. The work will be done in two parts, the inventory and engineering valuation of the Maryland Public Service Commission, and a historical study of the book value under Mr. B. McK. Bachman, expert accountant of the Commission.

The revaluation is being undertaken at the request of the gas companies, which was made in January, 1926. Start of the work has been delayed until the present summer through lack of commission funds. It is now being executed with money provided by the gas companies themselves, under a law enacted by the last session of Congress authorizing the commission to assess such cost against the companies. Under this arrangement $5,000 per month is paid into a special fund administered by the Commission and expended for the experts and assistants engaged on the work.

It is expected that the project will require from six to eight months. After this time the Commission will take the engineering and accounting reports into consideration in making its findings as to the rate-making value of the properties. It is stated that the gas companies expect the new valuation to be much higher than at present recognized and there is some discussion of the possibility of using such higher valuation as a basis for securing higher rates for gas.

* * *

Kings County Lighting Co. Files Certificate Reducing Shares of Stock

Albany.—Kings County Lighting Company has filed a certificate in the office of the Secretary of State reducing the number of shares of its $100 par value stock from 70,000 to 65,000 shares, with 50,00 shares non par value stock remaining same as heretofore.

Southern California Gas to Buy Midway Gas Company

Formal application has been made to the California Railroad Commission by the Southern California Gas Company for authority to buy the Midway Gas Company and the Valley Natural Gas Company. This follows closely upon a similar application filed by the Southern California Company for permission to purchase the Central Counties Gas Company, Hanford Gas & Power Company and River Bend Gas & Water Company. Upon the consummation of these consolidations the Southern California Gas Company will operate in the territory from the Los Angeles basin north to Dinuba, Hanford and Visalia, in the San Joaquin Valley, and from Ventura on the west to Redlands, Riverside and San Bernardino.

The application asks for permission to issue and sell thirty-five million dollars' worth of 5 per cent thirty-year bonds, to be secured by a new mortgage which will be a first lien on the combined properties. This will involve the redemption of all outstanding bond issues as follows:

Southern California Gas: First mortgage 6s of 1950, $4,354,000, callable at 105; first and refunding 7s of 1951, $2,747,000, callable at 107½; first and refunding 5½s of 1952, $6,200,000, callable at 105; first and refunding 6s of 1958, $4,000,000, callable at 105.

Midway Gas Company: First and Refunding 6s of 1929, $883,000, callable at 100.

Central Counties Gas Company: First mortgage 6s of 1939, $484,000, callable at 103; convertible debentures, 7s of 1929, $78,000, callable at 102.

River Bend Gas & Water Company: First mortgage 7s of 1942, $190,000, callable at 104.

Hanford Gas & Power Company: First Mortgage 6s of 1937, $70,000, callable at 101.

The Southern California Gas Company, during its twenty years of operation, has grown to be one of the largest distributors of gas in the world. In Los Angeles, San Bernardino and Riverside Counties it now serves domestic and industrial customers in over seventy cities and communities, and sells natural gas to other utilities.

The Midway Gas Company was originally organized fifteen years ago to bring natural gas from the Midway fields, near Taft, to Los Angeles. Since that time the company has expended its activities so that at present it brings gas from every important field in Southern California, which it sells to the Southern California Gas Company and other companies retailing gas in Southern California.

A. B. Macbeth, executive vice-president of the Southern California Gas Company, stated that the consideration for the sale was expected to be between twelve and thirteen million dollars.

* * *

William Hutton Blauvelt Appointed by Philadelphia Gas Commission as Its Engineer

New York. — William Hutton Blauvelt, Consulting Engineer, of No. 120 Broadway, New York who specializes in the manufacture of by-product coke and the production of gas, has been appointed engineer and expert for the Gas Commission of the city of Philadelphia. Mr. Blauvelt represented the city of Philadelphia in its negotiations with the United Gas Improvement Company for a new lease of the Philadelphia Gas Works, which was consummated about eighteen months ago.

In connection with Philadelphia's rapidly growing gas requirements, several plans have been suggested for the building of a by-product coke plant in or near the city and under the provisions of the new lease, bids for furnishing the city with coke oven gas from such a plant have been requested. Private interests have asserted that one or more blast furnaces should be added to this undertaking on account of the active iron market centering in Philadelphia.

Gas Compromise Reached by City and Electric Co. Gives New Fuel for Homes

Baton Rouge, La. — The City commission council and the Baton Rouge Electric Company reached a compromise whereby natural gas will soon be turned into the mains of the city. The new rate will effect savings of about 60 per cent in the average gas bill if the same amount of heat is used.

The new rate is: $1.10 for the first 500 feet, 70 cents per thousand for the next 69,500 feet, 40 cents a thousand for the next 60,000 feet and 25 cents a thousand for all in excess. The minimum bill is to be $1. It is also provided in the compromise that if the city commission is able to secure a reduction in the pipe line rates to the electric company this saving is to be passed on to the public.

Work Out Details

A number of details will have to be carried out before the natural gas can be turned into the mains. Arrangements must be made for changing the artificial gas burning equipment into natural gas burning, and the terms of the compromise will likely have to be put in writing or in the form of a city ordinance.

The electric company guarantees to give the city the same quality of gas that comes from the mains. This gas is now testing 950 British thermal units, as against 520 B.t.u. for the artificial gas now being used.

After getting additional data from other cities served with natural gas, the city commission concluded that the proposed rates were about as low as those other cities in similar circumstances are enjoying except those in the gas fields. The new rates are practically the same as those of Port Arthur and Beaumont.

The new rate will provide for a reduction of about 50 per cent in the average bill if the same number of cubic feet is used, but when the added heating qualities of the new gas is considered the reduction will be considerably more.